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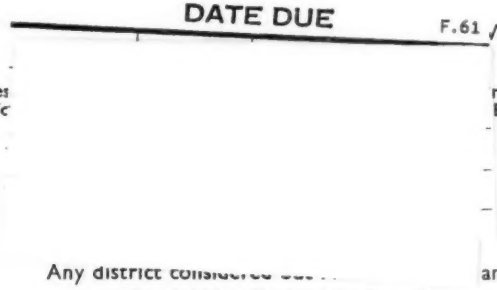

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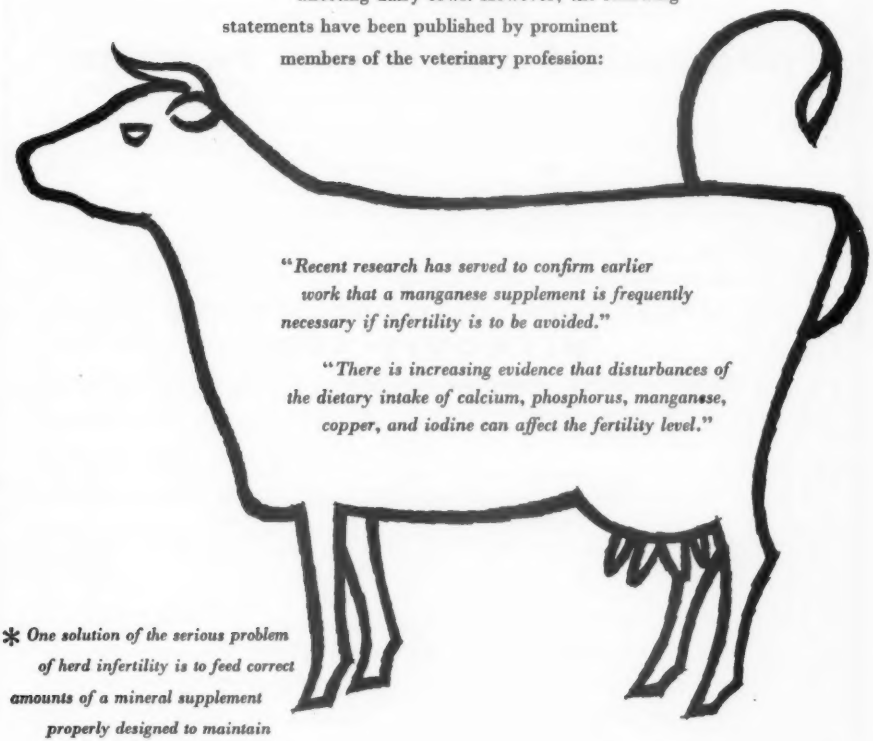

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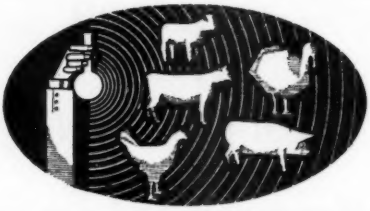

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Farming in the 'Fifties

W. B. MERCER, C.B.E., M.C., B.Sc.

A glance at the developments in science and practice that have marked the past decade.

THROUGHOUT the 'fifties agriculture has been fermenting under the enzymatic influence of the Agriculture Act 1947. Production of all major commodities has increased almost continuously, so that the net output index has risen from 143 to over 160—the forecast for 1959/60 is 168. The general course of agricultural history can perhaps be described as a return to normality after the stresses of a long war-time regime. Emphasis in price reviews has shifted gradually from greater production to greater efficiency. Free marketing has returned; some marketing boards have been restored or set up. The assessed aggregate net income of farmers has averaged £325m, but there have been considerable fluctuations from year to year; subsidies and grants have also varied greatly, from approximately £200m. to about £300m.

Tillage crops

It has been the declared purpose of price reviews to stimulate meat production and to maintain the area of tillage—upon which total net production has in the past largely depended. Yet with minor fluctuations the tillage area has steadily shrunk. Raised from a pre-war level of 9 million acres to 14·5 million by the exigencies of war, it began at once to decline when the war ended, and during the 'fifties fell to 11 million. In the same period the cereal area fell by one million acres. The decline occurred mainly in oats; barley actually increased.

The geography of British farming has returned to its pre-war pattern. Cereal growing is the domain of farmers in the east and south east and certain favoured spots in Scotland. Elsewhere the needs of stock over-ride the cash appeal of corn. The main fall in the tillage area has occurred in the west.

Cereal farming has become highly mechanized. Multiple-furrow ploughs, combine drills and harvesters and mechanical driers have reduced the demands on manual labour. New strong-strawed varieties of wheat permit heavy applications of fertilizers, with resultant heavy yields. Spring wheats, introduced during the war, have shown an immense advance on anything available before. Dual-purpose wheats have so spread the sowing seasons that today they nearly meet. With barley the tale is much the same: first Scandinavian, then Cambridge varieties have raised potential yields by 60 or 80 per cent. New sprays, of marvellous potency but quite unrelated and drawn from every part of the chemical spectrum, have given very great control of weeds.

Of other arable crops, it is sufficient to note the stable empire of sugar beet, grown under the close paternal control of the British Sugar Corporation. Prices, which for this product only are fixed, have risen by about twenty-five per cent. Precision drills and advances in the design of mechanical harvesters

characterize the history of the decade. Yields have varied markedly from year to year, the general level being much higher than before the war.

As was to be foreseen, demand for potatoes has fallen as more attractive fare has become available, though the total area under the crop is still a good deal higher than before the war, owing mainly to a rise in the acreage of earlies. Guaranteed prices serve primarily as a buffer against exceptional circumstances. The Marketing Board was restored under a slightly revised scheme in 1954. Some advances in methods of marketing may be recorded, notably the sale of washed potatoes presented in plastic bags, but the mysteries of quality remain unsolved and varietal choice (or at least supply) very localized. Kerr's Pink and Golden Wonder can readily be obtained in Scotland: England has a limited supply of Edwards, and for the rest seems content with Majestic: fortunately for the grower, it is a heavy yielder. On the cultural side, engineers still struggle with the baffling problem of a complete harvester able to deal with stones and trash (and sometimes weed, for late growths of fat-hen and kindred weed species defy selective herbicides). Indoor storage increases rapidly, chitting in artificial light but slowly. Altogether, arable farming has been a consistently profitable occupation: in the records of type farms published annually the arable and semi-arable farms lead all the rest.

Milk

The phenomenal war-time rate of increase in milk production continued into the 'fifties. Since the M.M.B. reassumed its functions, expansion has been checked by limitation of price increases and of the gallonage available for full subsidy. Output rose until 1957, has since declined slightly, and now stands at about 10 per cent more than in 1950. The size of the national herd has not materially altered.

The proximate cause of the steep rise in output per cow is written plainly in black and white or fawn and white. A.I. centres established by the M.M.B. and private organizations have given us a new national herd, mainly Friesian and Ayrshire. The ultimate cause lies much deeper. A generation ago tuberculosis brooded like an evil spirit over half the herds of England, destroying animals, clouding the initiative of men. Tuberculin testing, and later the bold scheme of attestation, exorcised that spirit; more, it inspired herd improvement. The attestation scheme, now reaching its climax, has been enforced by regional orders. It has been a costly operation in professional services and in initial bonuses. But it represents a major advance, and the fact that it has involved so little friction is a testimony to the public opinion created by the work of the pioneer T.T. producers. Alas that so few of those who blazed the trail remain with us today!

With greater certainty in breeding for milk has come greater reliance on home breeding, a longer life of adults in the herd, and in consequence a smaller annual intake of recruits. As trade in imported foodstuffs has revived (the volume is now nearly as high as before the war), old controversies on the most economic level of concentrate feeding have revived also, and most of the pioneering work in dairy farming during the decade has revolved around this point.

A good deal of research on nutrition has reached the point of exploitation

on the farm, particularly as regards calves, which under certain conditions can be reared well on very low allowances of milk. Systems of so-called "dry" feeding have accordingly come into existence. Re-examination of standards for adult cattle devised by Kellner has shown them to be on the generous side, and practice has shifted to production rations containing less protein.

Many examples of outstanding success in the exploitation of grass, usually by intensive grazing and silage-making, could be cited; probably most farmers achieve a home-grown winter ration of M+ and certainly many manage M+1. But feeding of dairy cows is still founded on extensive grazing, hay (now secured by pick-up balers), and bought-in balanced rations.

The building of cowsheds and yards has grown apace, together with a considerable extension of the yard-and-parlour system, a development with which releaser-type milking machines (and latterly tank collection) are often associated. Self-feeding systems for silage have become common.

The value of the milk produced annually far exceeds that of any other agricultural product. Profits from the national herd, while modest, keep fairly stable; on individual farms they vary between very wide extremes, according to the skill of the occupier, the vagaries of seasons or the run of luck.

Beef and lamb

Guaranteed prices for beef have been advanced faster than those for any other product; breeding has been encouraged by calf subsidies, provision of beef semen at A.I. centres and other means. The response has varied a little from year to year, but amounted at the end of the decade to an increase of about 30 per cent in the annual beef output.

The published accounts all tell rather a doleful financial tale; one could be forgiven for concluding from them that producers, like the celebrated trader, make a loss on each beast, but somehow achieve a profit on turnover. Taking the industry as a whole, profits appear to come entirely out of subsidies; on the individual farm they depend also on the cost of the calf. The breeder of calves has advanced from the foot of the farming ladder to its very top; even on the dairy farm a measurable portion of the modest profits commonly calculated as pence per gallon came in fact from by-product calves. The advance in the price of calves has resulted in some spread of rearing to farms which hitherto bought all their stores.

Summer beef production remains an extensive business, relatively safe in respect of profits despite a very wide seasonal range in guaranteed prices. Winter feeding problems centre in the utilization of by-products or in the search for an alternative to roots. Fattening on silage gains some adherents.

Sheep farming has had a relatively unchequered history. Total numbers have climbed slowly back to a figure near to that of pre-war years, though wethers are fast disappearing, and the bulk of the male lambs never see their first birthday. Most of the bacterial diseases of sheep have yielded to inoculants, and attention is now directed to control, by land management and drugs, of worm parasites. Guaranteed prices have kept in line with those of beef. Annual output has now passed the pre-war level.

Pigs and poultry

Regulation of the market for pig meat has presented many difficulties. In the early part of the decade, when we were still recovering from war-time losses, prices were advanced annually and production of pig meat was by 1953 greater than before the war. Latterly, to save foreign exchange on imported feed, prices have been reduced, both absolutely and by the operation of a formula relating them to feedingstuff prices. The decade ends, therefore, with standard prices below those of 1950. Yet production has more than doubled. The market for pig flesh divides between pork and bacon. Review prices for bacon provide premiums for bacon pigs of specified standards, but their effect has been minimized by an immense increase in demand for pork and processing meat; and open-market prices for porkers are consistently above those for baconers, sometimes indeed exceeding the guaranteed price.

Much attention has been given to problems of heredity and the "conversion ratio", i.e., $\frac{\text{foodstuffs}}{\text{l.w. increase}}$. Progeny testing stations have come into being, and a Pig Industry Development Authority has been set up to supervise technical progress. Antibiotics have proved their value in rearing: the outstanding result of husbandry research, however, has been the demonstration of the rather elementary fact that little pigs have to be kept warm. Nearly all modern designs of houses—many variants have been evolved—allow for accumulation of dung outside the feeding pens, and its mechanical removal.

The history of egg production has run parallel to that of pigs; the guaranteed price at the end of the decade was identical with that at the beginning, but production increased by 40 per cent. The latter part of the decade afforded clear evidence that, despite the vigorous selling policy of the Egg Marketing Board (established 1957), increasing production has resulted in very heavy demands on the Treasury. The trend towards intensive methods, particularly of deep litter housing, has continued unabated.

A new branch of poultry keeping has arisen and grown mushroom-like in the space of a few years—a portent of the nation's rising standard of living. Immense numbers of chickens are now being hatched and fed in close confinement for ten or twelve weeks, to find their way on to the market at prices competitive with pork. What the limits of this market may be no one can see as yet.

Recruits to farming

As the break-up of estates proceeds, more farms pass into the hands of owner-occupiers; others are let by tender at greatly advanced rents. Both processes result in new entrants with no immediate farming ancestry—they represent new blood and new capital. Capital requirements for farming are now very high. It is true that banks are lending much more freely and hire purchase can be resorted to, but both devices are of more use to the established man than to the beginner. The path of the young entrant is steep and stony, unless he has an indulgent father behind him. It is scarcely possible to "work his way in" through cottage and smallholding to a farm of reasonable size.

The agricultural colleges are bursting at the seams. Few of the students are sons of farmers, though some are the farmers of tomorrow; others find eventual employment in business with agricultural firms or start on the ladder leading to managerships of farms.

Rather more than 2,000 students pass annually through the thirty-five farm institutes now in being. Here the supply of places is just about equal to demand. Again, the majority look to employment on farms. (The proportion of farmers' sons varies markedly and inexplicably from county to county.) Great as educational progress during the decade has been, the proportion of trained men amongst the annual entrants to the industry, whether as farmers or workers, is still low.

It is to the part-time courses conducted by the L.E.A.s that the industry looks for the training of most of its recruits. Here rapid progress can be recorded, after a rather ragged start.

Technical aid

Direct technical aid flows from a variety of sources. The Milk Marketing Board, already the main depository of cattle breeding records, becomes the overseer of dairy cattle breeding throughout England and Wales, and the promoter of many technical advances. The formation of P.I.D.A. presages perhaps similar developments in pig husbandry. The Poultry Stock Improvement Plan achieves much the same ends by different means. The British Sugar Corporation is at once a controller and adviser in its own field. Trading firms translate research findings into practice through trials, literature, and personal contacts of salesmen, highly trained in narrow fields.

The Ministry's Animal Health Division, through its field and laboratory services, deals with the many problems associated with farm livestock. And finally the N.A.A.S. endeavours collectively to cover the rest of the whole field, with its own experimental farms, its "general practitioners" in all districts, and consultants at regional centres.

Twelve experimental husbandry farms are now in being, all conducting long-term trials on major problems such as the influence of leys on fertility and the influence of rearing methods on the life histories of cows, as well as ephemeral trials on crop varieties, fertilizers and so forth. Six experimental horticultural stations are similarly engaged on horticultural problems. On the larger themes, results are necessarily slow in emerging, but as data accumulate trends can be discerned, sufficiently reliable to influence field officers' advice and to stir the imagination of visiting farmers.

In the early years, from sheer necessity the field officers carried the staff burdens of the C.A.E.C.s as well as their own, but the duties of the C.A.E.C.s are now largely in the field of technical development and the advisory service functions pretty much as it was designed to function. Certain lines of work have not developed as expected: others have expanded beyond anything originally envisaged. Emphasis has shifted from the technicalities of production to financial efficiency, to the intricacies of investment, turnover and budgeting—in short, to the economics of production. To parody A. J. Balfour's famous dictum of half a century ago, "we're all economists nowadays".

Work Study

R. W. HELME, B.Sc., N.D.A.

National Agricultural Advisory Service, Rossendale, Lancs

Work study is now being used not only to examine labour costs on individual farms, but also to compile standards by which the efficiency of labour use can be judged in future.

IT is now about ten years since the industrial technique of work study was first used in agriculture in this country. Like most new techniques, it was given a very doubtful reception: many people could not envisage its fitting into the complexities of farming. Today we are beginning to see what can be achieved, and farmers are starting to accept it as a further tool for farm management. This change has, no doubt, been brought about by the fact that British agriculture is facing severe competition. The recent price review stressed the problems of maintaining farm profits; the emphasis must be even more strongly on reducing cost.

It must be stressed that work study deals only with labour, and therefore any savings that it can bring about relate solely to that one item. But labour takes up approximately 30 per cent of farm costs: the figure may be as high as 50 per cent on arable farms, or only 20–25 on dairy farms. It is interesting to note, too, that as the work study officer records in great detail what is actually going on, several husbandry factors frequently come to light.

Before a work study can take place, some system of farm management analysis must be carried out, to show whether a work study is really necessary. And we must look at the farm business as a whole, as distinct from using the technique of cost accounting—which is frequently applied when enterprises are reviewed individually. Agriculture has a high proportion of fixed (overhead) costs, and these can easily be overlooked in simple enterprise costing.

If a farm management analysis shows that a farm has a high labour cost, work study can help in one of three possible ways:

1. By enabling the farmer to expand his business with the same labour force. This may prove dangerous in times of over-production; perhaps time saved as a result of work study should be devoted to cost-reducing enterprises rather than to expansion of the business. Such items as home-mixing feedingstuffs, and maintenance and repair of farm buildings, would come under this heading.
2. By reducing the unit cost of any commodity through a reduction in the labour charges; and
3. By making the job easier, reducing the fatigue and drudgery, and so giving the farmer more time to think about his business and the stockman more time to look after his animals. In this country most work study has been done on livestock farms, even though labour plays a more important role in relation to cost on arable holdings.

Much of the work in and around the farmyard in winter is daily and repetitive, and this no doubt is why it has been attacked first. The task of silage feeding, for instance, has been studied on many northern farms. The follow-

ing table shows five different methods used and the corresponding differences in the rates of silage feeding.

Rates of silage feeding

Method	No. of cows	Weight fed per cow (*lb*)	Time (*minutes*)	Weight fed (*lb per minute*)
1. Cut by hand, wheelbarrowed to cowshed, tipped and forked to each cow	34	60	81	25
2. Cut by hand, loaded on to trailer, tipped outside cowshed and forked to each cow	46	70	107	30
3. Cut and carried by hand to each cow	37	100	94	39
4. Cut, loaded on feeding trucks, transported into cowshed and fed direct	39	85	64	52
5. Cut by hand and thrown into troughs for self-feeding	22	100	27	81

Methods 1 and 2 show that by the traditional silage-feeding systems of handling two or three times the rate of feeding is 25–30 lb per minute, or a ton of silage fed in approximately eighty minutes. With the third method, where the number of handlings is reduced, the rate of feeding is increased by 25 per cent; and when a simple trolley mechanism is brought in, the rate of feeding can be doubled. Method 5 shows that where simplified self-feeding is used, a ton of silage can be fed in thirty minutes.

This approach can tell the farmer what savings would be effected if he switched from one type of silage feeding to another, and it can be applied to most farm tasks.

Savings follow a similar pattern on all farms

The interest in self-feeding of silage, and consequent introduction of loose housing and yard-and-parlour milking, has also provided useful information as a result of work studies. The traditional cowshed system was work studied on a number of farms in 1959, and repeat studies have been made in 1960, after almost a winter of loose housing. It is interesting to note that the savings in labour on all farms follow a very similar pattern. Examples of this can be seen in the table on p. 170.

It has been found from several studies in the north west that the average time spent per cow per week in the cowsheds is approximately 115–130 man/minutes, as illustrated by farms A and C, although figures as high as 160 have been recorded where there has been a very difficult layout, and as low as 90 with a difficult building layout but a very good feeding and milking routine. It can be generally accepted, therefore, that a figure of slightly over two hours per cow per week is the normal work load in winter in the cowshed system. This can be improved upon in many instances without resorting to the yard-and-parlour system and all the cost involved. Nevertheless, studies have not shown any cases where the weekly figure has been less than 90 man/minutes per cow, even with the most efficient cowshed system.

Farms A and B illustrate the type of saving that can be achieved with a

normal system of loose housing: their "cowshed" figure can be reduced to 55–65 man/minutes per cow weekly. Other studies like this have shown that the normal work load on the yard-and-parlour system is about 60 minutes per cow per week, although figures as high as 85 and as low as 45 have been recorded. It can be shown from the table below that in every case the proportion of time spent on milking under the new system has increased by 4–5 per cent, and the time spent on feeding and cleaning correspondingly decreased.

Daily work routine in minutes

	Farm A		Farm B		Farm C	
	Cowsheds	Loose housing	Cowsheds	Loose housing*	Cowsheds	Loose housing
No. of cows	35	35	39	62	37	76
Milking	221	147	281	272	340	263
Dairy work	91	66	76	77	123	71
Feed hay	35	8	5	—	8	—
Prepare food	33	3	39	6	26	10
Cleaning	99	59	57	93	84	102
Cut and feed silage	96		86		94	
Bedding		32	34	82	13	40
Collect cows		12	15	6		10
Total man/minutes	575	327	593	536	688	496
Minutes/cow/week	115	65	106	55	129	45

* Farm B on loose housing puts bedding down only three times weekly.

Where a farmer changes from the cowshed system to loose housing he can, in fact, look for a saving of approximately one hour per cow per week in his winter routine. The capital cost of making the conversion has, of course, to be seriously considered in relation to the number of cows kept. Apart from the capital cost of conversion, the annual cost of bedding and extra fertilizers needed for the additional silage have to be offset by increased milk production. In each of the three examples quoted, at least one man has been saved in looking after the dairy herd, and it is normally assumed that the annual saving of a man's wages can be equal to the spending of £5,000 of capital spread over twenty years.

Reducing work on a poultry farm

Similar production studies have also been done on poultry farming systems. One example of this is the recent study on a 4,000 bird cafeteria cage system. The problem here was to reduce the daily work on the birds with as little capital expenditure as possible. An initial study showed that 63 minutes a day (15 per cent of the daily total time) was spent on feeding, 41 minutes (10 per cent) on cleaning, 189 minutes (45 per cent) on egg collecting, and 128 minutes (30 per cent) on culling and refilling cages—a total of 421 minutes, every day. In addition to this, the following tasks were carried out once a week; recording (628 minutes), gritting (22 minutes), cleaning cages (209 minutes), cleaning floors and walls etc. (132 minutes)—991 minutes weekly, giving a total week's work for the 4,000 birds of 65½ hours.

It will be seen from the analysis of the daily chores that feeding and cleaning occupy a relatively low percentage of the time, while egg collecting is the most time-consuming factor. Recording, taking almost 10½ hours a week, is

the next biggest single item. The egg collecting, recording, cleaning and feeding were all submitted to a critical analysis. Only minor savings could be suggested on the feeding, and the system of cleaning was accepted as being satisfactory.

Owing to the design of the building neither the feed nor the egg collecting trolleys could be taken down the outside alleys, and all feeding and egg collecting on the outside had to be done by hand, which not only takes time but involves a considerable amount of walking. Also from the rigorous culling policy of this farm there appeared to be considerable duplication of recording: the individual cages were recorded daily at the time of egg collecting, weekly by the recorded entry on laying sheets, and again when the culling and refilling took place. All eggs going into the egg storage room had to be carried up five steps. Some redesigning was desirable so that eggs could be taken direct into the egg room and need no loading at that point.

On egg collecting and recording it was felt that block records for a set number of cages would be sufficient, and that only when the block totals fell below an accepted laying percentage should individual cage recording come in. And instead of the eggs being collected direct on to small trolleys which were pushed around by the egg collectors, as at present, they could be collected direct on to trays, and the trolleys used as temporary storage racks at appropriate intervals along the house. By this system, the egg collecting time could be reduced by at least one-third, and the weekly recording cut by half.

Work study techniques are also being used for investigating efficient, practical methods of handling crops such as apples and potatoes in bulk. There must be close attention to quality control but, with certain safeguards, handling crops in bulk can reduce the incidence of damage.

The type of studies described here, and the data collected from them, can only be looked upon as production studies at this stage. It is also possible from work studies to collect standard times where a system can be accepted as the most efficient possible. The collection of standard data is proceeding, and is of paramount importance in British agriculture, but owing to the great variation in farming systems it is an extremely slow task.

Kales for Late Feeding

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Further trials, following up an earlier series, of several promising kale and rape varieties for late feeding suggest that in the south west, thousandhead gives the heaviest total yield, but Canson and hungry gap are the most suitable.

BY the end of the year probably the majority of kale graziers in the south west switch to grass silage, but quite a number, and especially those on drier land, continue grazing kale as long as the crop is available and weather conditions permit. In addition there is an interest in late kale for sheep.

For some years before 1955 the National Agricultural Advisory Service, in co-operation with the National Institute of Agricultural Botany, compared a wide range of kales and rapes in the south west. It was clearly shown in these comparisons that marrowstem kale had easily the greatest productivity for use up to Christmas, but that it was of uncertain value after that time owing to susceptibility to frost damage.

In 1956 and subsequent years the most promising kales from the early trials were grown in larger plots, for feeding off, when possible, in late March. These late feeding trials have been grown in our six south-western counties, and the series is still continuing in one or two hill areas. The kales chosen were Asparagus, Canson, *Chou fourrager de Cholet*, Cottager's, Green Curled Scotch, hungry gap, rape kale and thousandhead. Of these, however, Cottager's and rape kale were soon discontinued, the former as being not particularly productive and having a fibrous stem, and the latter as being very similar and possibly inferior to hungry gap. *Chou fourrager de Cholet* has only recently been included and, although promising, must await fuller testing before comment.

The most striking feature of the trials has been the variation in behaviour of the different kales from season to season, from Gloucestershire to Cornwall, and from lowland to upland farms. Such differences must make one very chary of being dogmatic in the interpretation of the results to date. There have been, however, some fairly clear trends. Thousandhead kale (which normally yields from two-thirds to three-quarters as much as marrowstem kale) was the highest yielding. Canson yielded almost as well and, moreover, had a much greater proportion of leaf to stem and was less "leggy". All things considered, it was the most useful type in these trials, for feeding off with an electric fence in the early months of the year. Green Curled Scotch also yielded quite well, and might be considered where there is a good market for spring greens for human consumption. Hungry gap and Asparagus kale generally, but not invariably, yielded considerably less than the other kales, and after the very severe winter of 1956 they gave scarcely

any spring keep at some centres. In the milder seasons, however, and the further south west they were grown, the better were their yields relative to the other types. Hungry gap was generally preferred to Asparagus kale.

Wastage

The proportion of crop wasted by stock was sometimes very high in all varieties, but generally it tended to be much less in the dwarf types, such as hungry gap, Asparagus and rape kale, than in the taller kinds, and this partially offset their lower productivity. Sometimes there were also clear indications that stock preferred the dwarf kales. Both thousandhead and Green Curled Scotch were very leggy and were liable to lodge by late spring.

It is widely thought that hungry gap is the hardiest of the kales, but the trials in 1955 and 1956 clearly contradicted this viewpoint. Not only did thousandhead and Canson withstand the intense cold better than hungry gap, but the small amount of green on the latter was taken by pigeons, who found it easier to feed on the low-growing kales than perching precariously on the taller ones, although the taller kales also suffered some damage. After such prolonged cold spells the amount of feed was small, even on Canson, but nevertheless very valuable on any farm where fodder was scarce.

Crop yields were estimated by weighings taken at intervals through the winter, and these showed that the amount of food was greatly reduced in very cold seasons, while in mild seasons most kales increased considerably in weight throughout the winter. As the season progressed, thousandhead and Canson produced more new growth (shoots) than the dwarf types.

The kales become more fibrous and less palatable as they run to flower. The start of flowering varies greatly from season to season and between different kales: Canson flowered a little later than thousandhead, while hungry gap, the latest of all the kales grown, flowered very much later, a factor of some importance in planning late spring feed.

The dwarf "kales"—asparagus, hungry gap, and rape kale—are not true kales but belong to the rape family, and were very susceptible to mildew. In dry seasons like 1959, this proved lethal at some centres. Further information is being obtained about susceptibility to club root, but hungry gap was markedly the most prone at several centres where the disease occurred.

Most of our kales have been selected and maintained by means of mass selection, so that each type may vary considerably from stock to stock, and marked variation in growth habit and behaviour may be found between different seedsmen's stock of the same type of kale. The stocks used in these trials were considered to be good representatives of their respective type of kale. Our conclusions to date are that although thousandhead usually gives the greatest total yield, Canson and hungry gap are the most useful for late feeding; the former for a general expectation of utilized yield and frost hardiness, and the latter for extra late feeding.

Heavy Land Farming

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Whether the farm is arable or livestock, some of the disadvantages of heavy land can be overcome by drainage, liming and labour-saving buildings.

MECHANIZATION has done much to solve some of the worst problems of clay-land farming during the last twenty years, but with the intensified competition that may be anticipated in agriculture some of these problems may become serious once more. Since the earliest days of agriculture the management of clay-land farms has been a difficult business, and in times of agricultural depression this type of farm has generally been the first to go out of production. It does not need a long memory, for example, to recall the thousands of acres of heavy, wet land that were lying derelict in the bad farming years between the two world wars.

Any thoughtful person today must anticipate more testing times ahead in agriculture, particularly if European integration becomes a *fait accompli*. Some sacrifices will certainly have to be made for this ideal, and the clearest signs are that agriculture will be called on to make some of those sacrifices. If this is so, will modern developments in agricultural technique enable the heavy land farmer to survive in competition with his more favourably placed neighbours, or will history repeat itself, and these farms once more tend to drift out of cultivation?

Short growing season; higher costs

To attempt an answer to this question, it is important to consider some of the disadvantages of heavy land, when compared with kinder soils. They can perhaps be summarized under three headings: relatively short growing and stocking season, higher cost of working the land, and greater expense involved in keeping livestock.

The short season is primarily due to the high moisture content of a colloidal soil, which loses water slowly both by drainage and by evaporation in the spring, and accumulates it rapidly in the autumn and early winter. This high moisture content leads to coldness, lack of aeration, restricted root and stem growth, and to mechanical damage to the texture of the soil by implements or stock, which accentuates still further the bad physical condition. As any really heavy land farmer knows, puddled clay can be either putty or concrete, and neither is a good medium for plant growth.

Obviously this fundamental disadvantage cannot be dissipated entirely, but some degree of alleviation is possible in several ways.

Good drainage essential

Efficient drainage is an essential, whether by tile or mole, though the high cost today, in spite of grants, makes it appear an unattractive proposition in

many cases. It is, unfortunately, often difficult to see or to calculate a concrete return on capital invested in drainage, and properly conducted trials, fully costed and run on an economic basis, are urgently needed to prove that it really is worth while. Where adequate power is available and moling is possible, the best solution is probably to lay strategically-placed mains, and then to draw moles over those mains at fairly frequent intervals. Even if the soil is not really ideal for mole draining, a considerable advantage can be gained from a system of this kind, provided the mole plough is drawn through regularly, and the mains are well constructed. On both arable and pasture, a good drainage system will be needed in the future if the farm is to remain competitive.

Improving soil structure

A step which may help the arable farmer in particular is liming. Even though a soil test may not show any marked acidity, an application will often improve the physical texture and workability of a clay soil to a quite remarkable extent. With the subsidy, the annual cost per acre of an application every 5–8 years is really very small.

Then there is the question of organic matter. Though opinions may differ on its value as the result of experimental findings recently published, in my experience a reasonable quantity of organic matter in a really heavy clay soil can have a striking effect on both workability and drainage. The better aggregation of the soil particles makes it more difficult to puddle the clay, and induces an easier breakdown of the furrow slice under difficult seedbed conditions, especially in the spring. At the same time, an apparently easier movement of water through the soil leads to better aeration and earlier warming up, and to a smaller risk of the soil packing down like concrete after heavy rain. Lack of organic matter in a clay soil tends to become a vicious circle, for aeration is impeded, root growth is thus restricted, crops are smaller, and consequently less residues are ploughed in. The soil then loses condition still further, crops get worse, and so it goes on till the soil becomes almost unworkable, and the crops uneconomic in yield.

Importance of weathering

Weathering is a tremendously important agent in the management of clay land. Though autumn-sown crops are to be preferred, the presence of wild oats, black grass, wild onion, or cereal diseases may make spring cropping inevitable. In this case, it is essential to throw up as much land as possible to the frost, rain, and wind between October and March. It doesn't matter too much (unless the land is very foul) whether the furrow is properly turned or not; the main aim is to get a lot of soil exposed to the elements. A full summer fallow is a wonderful treatment for a heavy soil, but can we afford it today? Some good farmers maintain that we can, but this is probably on the larger farms. With a limited arable acreage on the smaller farms, one cannot carry it, and an alternative is a bastard fallow after an arable silage crop or a ploughed-up ley. (A good ley, of course, is also extremely valuable as a soil conditioner on heavy land.) The bastard fallow is admittedly a risk, and can be a serious problem in years like 1957 and 1958, but if it is ploughed early enough, it will usually prove successful.

These four factors, then, can all be considered as a means of softening the worst effects of heavy land and of helping to lengthen the season, but even when they are exploited to the full, there still remain the two further disadvantages—the high costs of working the land, and of maintaining the livestock.

The higher cost of working, reduced to its simplest terms, is due to the more powerful equipment required, and the greater number of cultivations that are generally needed.

Equipment in the form of motive power and implements was expensive even in the days of the horse and steam tackle. It is no less so today, owing both to the actual power needed to move the soil, and also to the necessity of working a possibly biggish acreage just when conditions are suitable. To be successful, a farmer on heavy land has to err on the side of having too many implements, or he may lose that vital day, which can make a difference in some cases of 3–4 weeks in drilling time, and perhaps a loss of 10–15 cwt per acre in cereal yield. Similarly, his range of implements has to be larger than that of his light land competitor. There is really no escaping this higher cost of equipment, so that it is all the more important that the work should be done to time, to ensure a high enough yield to cover the interest on the extra capital invested. It is difficult to give a definite figure for this extra capital, but a guess of £4–5 more per acre invested in machinery would probably not be wide of the mark.

Clearly, the degree of extra working that the soil will require will depend on the extent to which it has been possible to improve its texture physically, and it is also in the timing of operations that the real skill of the good heavy land farmer can be appreciated. A cultivation at the wrong time may lead to many extra workings later on, and the basic lesson to be learnt is that of patience. This is a difficult lesson to learn in a tricky season, but it is generally rewarded with lower costs of cultivation, particularly in the spring. In the autumn, however, too much caution is undesirable, for the opportunity may then be lost completely. The combine drill has greatly reduced the risks of planting in a sketchy seedbed in the back end of the year; and quite considerable liberties can be taken, for timeliness is vital here, to ensure full winter establishment.

Livestock: better buildings the key to success

On the cropping side, too, the financial returns are limited by the relatively restricted range of cash crops that can be grown, for many have to be processed through livestock. This may prove costly if the livestock enterprise is not very well conducted; and it leads to the third problem of the heavy land farm—the higher cost of keeping livestock.

The main disadvantage is the short grazing season which is imposed if severe winter poaching of pastures (with consequent lateness and low yield in the spring) is to be avoided. Three items of expenditure are involved here: the provision of buildings to house the stock off the land, the cost of conserving larger quantities of food for such stock, and the cost of actually feeding this conserved food over a longer period.

The supply of good buildings is often grossly inadequate on many of the smaller clay-land farms—which are just those that need them most—prob-

ably because the rental returns from such farms have always been too low for landlords to have equipped them properly. The last ten years has seen a tremendous improvement in this respect, for better farm prices have justified the investment of capital in new buildings. Up-to-date yards and boxes close to a storage area can greatly reduce the costs of feeding, and possibly save the wages of a man in the winter months when compared with the old lay-out. Such a saving can go far towards paying the interest on the capital invested in the reconstruction.

The introduction of the forage harvester has done much to assist in conserving the extra fodder, and the key to the future of heavy land livestock farms must surely lie in the raising of adequate capital to effect building improvements. If this is done, the land can be protected from the worst effects of winter grazing, and its output thereby considerably increased. The crux of the matter is, of course, the raising of the extra capital, but fortunately in recent months this has become rather easier, though the basic question must still remain: can the interest on that capital be found in future years if farm prices continue to fall? This can be answered only by a detailed analysis of the potential of each particular farm, and by trial budgets; but we should also ask, what will the future be if the improvements are not carried out?

Future of large and medium-sized farms

The survival and success of the heavy land farmer will naturally depend to some extent on the type of farm and the district in which it is situated. On the larger farms in the drier eastern counties, where there is usually a large acreage of arable land, there seems to be little to fear. These farms can probably produce wheat as a cash crop as economically as any other farm in the world, and the soils are strong enough to produce two such crops in the rotation. The system will probably be largely streamlined down to cereals and grass leys, perhaps coupled with seed production, and with one major and perhaps one subsidiary livestock enterprise to cash the leys.

The medium-sized farms in the higher rainfall areas of the Midlands or west may be a bigger problem, for they are, by tradition, mixed, and would require a high investment of capital in both crop and livestock enterprises to remain competitive in both. In past depressions, many of these farms became little more than ranches, able to keep in production by a low output obtained at a very low cost, and at the sacrifice of hedges, ditches, and soil fertility. If harder times return the best future here will probably lie in stock production rather than crops; but it is to be hoped that the provision of better buildings in the past decade and at the present time will enable them to be farmed far more intensively than they were in the depressions of the past. The mechanization of grass conservation and improved buildings should ensure economic production at this higher level.

An answer for the small farm

Finally, what hope has the small clay-land farm if prices decline? The answer must surely be an all-grass farm, specializing in milk production, with perhaps one subsidiary livestock enterprise. There seems little future in

any arable cropping on such farms, for there is certainly no justification for capital expenditure on implements, or even on contractor's bills, except for direct re-seeding. Such a farm, perhaps carrying a forage harvester (and how long will it be before the manufacturers give us such a harvester which the small man can afford?) and concentrating on silage, with perhaps pigs or hens as subsidiaries, with buildings well laid out, should weather a depression as well as, or better than, many a larger farm. The perfection of slatted floors would help to remove the grave disadvantage of this type of farm on heavy land, namely the shortage of straw.

In conclusion, the difficulties and problems of heavy land farming still remain with us, and always will, though modern developments may mitigate their worst effects. Now is the time to look ahead and lay plans for forestalling harder times if they come upon us. So far as can be seen, the best insurance that the small or medium-sized farm can be given *now* is better and labour-saving buildings, for if this can be done while the going is good, it will go far to help stave off the worst effects of a future depression.

Flood Protection on the Great Ouse

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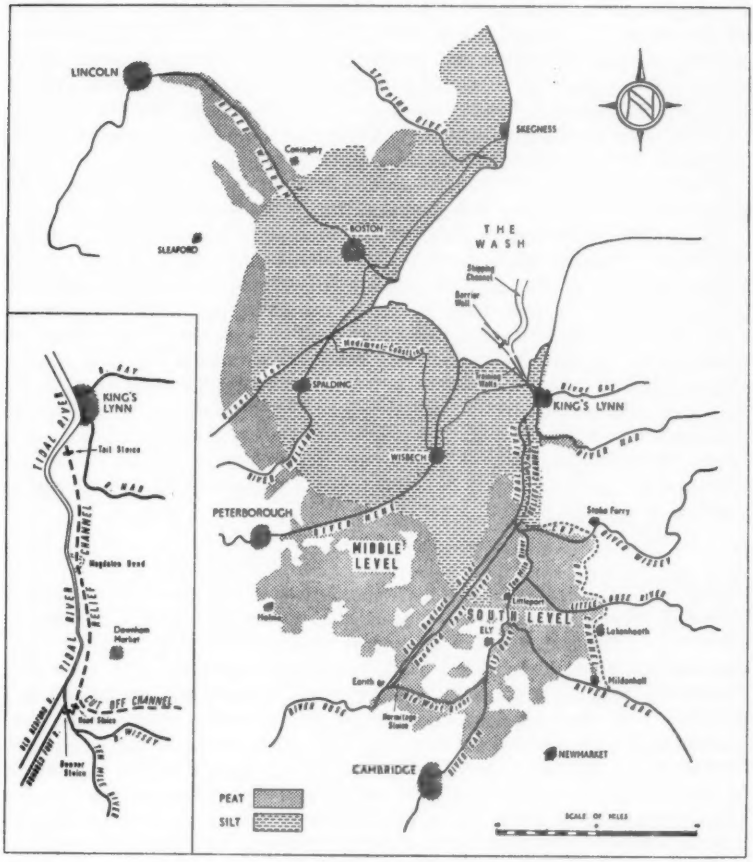
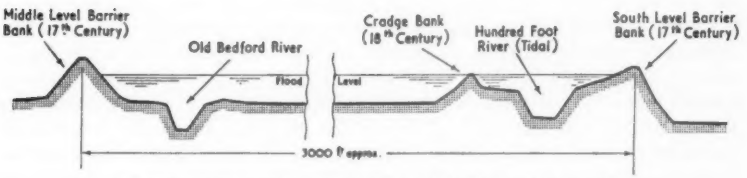
The making of a twenty-nine mile cut-off channel round the east and north of the South Level of the Fens is only the latest phase in a struggle with nature that has been going on since the earlier part of the seventeenth century. It is a struggle that has brought a rich reward, for the land is of the highest value to the nation's agricultural economy.

SOME sixty million years ago the East Anglian Heights were one with the Wolds of Lincolnshire, broken only where the predecessors of the present Fen rivers had carved gaps on their way to what may have been a former estuary of the Rhine, now the North Sea. The erosion of the Chalk by the rivers, and a general fall in the level of the land, let the sea into the soft Jurassic clay plain to the west and south, leaving as islands only the higher parts, of which the Isle of Ely is the most notable example. Following the Ice Age, which left these islands capped with boulder clay, the seaward half of this great gulf filled up with marine clays, silts and sands, such as the buttery clay; whilst the vegetation of the freshwater swamps to landward, where the upland rivers spread out over the plain, decayed to form layers of peat originally up to sixty feet thick. Temporary growths of vegetation, corresponding to changes in the relative levels of land and sea, caused layers of peat to form in areas that are predominantly silt.

By medieval times the Fens had become for the most part swamp, bordered on the east and south east by the chalk uplands of Norfolk, Suffolk and Cambridgeshire, and on the west by the Jurassic limestones and clays of



The Great Ouse and the Fenland.



Diagrammatic section across the washlands, looking north.

Huntingdonshire, Northamptonshire and Lincolnshire. Between the peat and the sea lay the partly-drained silt zone. The Great Ouse descended from the uplands of Huntingdonshire and Bedfordshire to flow round the east side of the Isle of Ely, past the village of Littleport, to meander north west to meet the sea just north of Wisbech, being joined by the Wissey and the Nene on the way. Only the small rivers Gay and Nar and some other, unnamed, minor streams flowed out to sea at King's Lynn. Following the silting of the outfall at Wisbech these courses changed, and an artificial cut near Littleport in the thirteenth century was the final step in diverting the Ouse to Lynn.

At the time of Domesday, only the silt belt and the islands were inhabited. Arable farming was carried out on the islands and the few permanently drained parts of the fen; ground that was free of water for long enough was used for pasture, hay and turf-cutting, and the permanently inundated region gave rise to fowling, fishing and the gathering of reeds and rushes. Salt was made along the tidal margin of the Wash. This economy was gradually changed by the piecemeal reclamation and drainage that were carried out during the Middle Ages round the islands and in the silt zone, which, by the middle of the fourteenth century, according to Darby,* had made the silt belt "many times as prosperous as the surrounding upland". The peat lands had improved too, but not nearly as much: they were still "only one-quarter to one-half as wealthy per unit area" as the upland.

Old Bedford River: the problems

With greater attention to drainage came an increasing number of disputes about the maintenance of embankments, channels and sluices. These, and disastrous flooding from both sea and river, led to proposals for a comprehensive draining of the Fenland, like that of Humphrey Bradley in 1589; but still only piecemeal schemes were carried out, probably owing to lack of capital, until 1634. In that year, through the enterprise of certain gentlemen "Adventurers" and the fourth Earl of Bedford, a major drainage was begun by the Dutch engineer Cornelius Vermuyden. Its principal feature was the cutting of a straight channel, twenty-one miles long, from Earith, near St. Ives, to Denver, in Norfolk, to by-pass the old course of the Ouse round Ely.

The Old Bedford River, as it became known, was not entirely successful, and after the Civil War a second channel, the Hundred Foot River, was cut to the east of it. At the same time sluices were built across the Ouse at the Hermitage and Denver to exclude from the South Level both the upland waters from above Earith and the tides. Barrier banks were built to the west of the Old Bedford River and to the east of the Hundred Foot, so that the intervening summer pasture could be used as washland for the temporary storage and discharge of upland floods. The work was a success, but the drainers were soon faced with physical problems that bedevilled the drainage of the South Level until the coming of the present scheme. As soon as the peat was drained it began to shrink, because of the reduction in moisture content and the action of aerobic bacteria, so that the fens sank below the level of the rivers and drains that ran through them. Between 1848 and 1932, at Holme Fen, in the Middle Level, a total subsidence of nearly eleven feet

* In *The Medieval Fenland*. Cambridge University Press 1940.

was recorded; but the present rate is about an inch a year. Throughout the succeeding centuries the banks of the rivers were continually having to be raised, and owing to the size of the task and the poverty of much of the material available there were many alarms and floods. The drainage of the low lands was barely saved in the eighteenth century by the use of large numbers of wind-driven scoop wheels and Archimedean screws to lift the water into the high-level streams; but more dependable pumping was obtained with the coming of the steam engine, and today the work is done by oil engines and electric motors.

To these difficulties were added those of only a very slight gradient and a sediment-laden estuary, which combined to cause deterioration of the tidal section, particularly below Denver. In times of flood, the water coming off the uplands down the Hundred Foot River combined with the tide to raise the level at Denver sluice, so that the flood waters of the South Level, pent up behind it, overtopped and burst their banks. After the first Denver sluice blew up in 1713 the water from the Hundred Foot River actually flowed south, up the Ten Mile River towards Ely. The construction in 1825 of Welmore Lake sluice, at the northern end of the washlands—a dam had been built in 1756—enabled levels below Denver sluice to be reduced to some extent by retaining water at a high level in the washlands, but this places an excessive strain on the Middle Level barrier bank.

MacDonald's solution

Vermuyden himself proposed to solve the South Level problem by making a channel round the foot of the eastern uplands to carry the waters of the Lark, Little Ouse and Wissey into the Great Ouse below Denver, and other proposals were made by Rennie in 1809, Wheeler in 1884, and others; but once again, no comprehensive plan was adopted. Bank raising continued, and improvements were carried out, such as the making of the Eau Brink cut just south of King's Lynn in 1821; but they provided only temporary relief, and floods, threats of floods and areas of bad drainage remained. Shortly before the last war several ideas were put forward, and after the flood of 1937, the Great Ouse Catchment Board sought the advice of the late Sir Murdoch MacDonald. He reported in 1940, recommending a scheme very similar to the present one; but it was decided on grounds of cost, and with his agreement, that the cut-off channel should be omitted. Shortages caused by the war prevented work from beginning before the floods of 1947, which greatly exceeded anything that had been expected. Whereas Sir Murdoch had designed for a maximum discharge of 7,700 cubic feet a second, at the height of the flood the gauge recorded 10,000 and then went out of action; 37,000 acres of South Level were inundated and much flooding was only narrowly averted. To prevent a recurrence the cut-off channel had to be reinstated, and Parliamentary approval of the complete scheme was obtained in 1949.

The MacDonald scheme is similar to that proposed by Vermuyden. A cut-off channel, starting on the river Lark near Mildenhall, will pass round the edge of the eastern uplands and carry upland floodwater from the Lark, Little Ouse and Wissey to the head of a relief and tidal storage channel at Denver. It will pond between tides, and be released automatically through a

tail sluice into the Tidal River near King's Lynn when the tide falls. The Ten Mile and Ely Ouse Rivers are at present being widened and deepened, and a connection, controlled by a head sluice, has been made between them and the relief channel. The scheme will protect the 189,000 acres of the South Level and remove the threat to the Middle Level causd by retaining high levels in the washlands.

Vital function of relief channel

The function of the cut-off channel is obvious enough; to prevent excess upland floodwater from the Lark, Little Ouse and Wissey from ever reaching the South Level. The relief channel, besides being an inter-tidal storage reservoir, has the vital function of reducing water levels in the Ten Mile River at Denver sluice. Its surface gradient is three inches a mile in full flood, as against 13·4 inches a mile in the Tidal River, so that with a low water level one foot below Ordnance Datum at King's Lynn the level at Denver will be 1·6 feet, as against a previous high land flood level of 10·0. The improvement to the Ely Ouse and Ten Mile Rivers will flatten their gradients so that this lowering is transmitted upstream, and high flood level at Ely will be about two feet six inches less than in 1937. Thus the old problem of the South Level waters being held up by high levels at Denver sluice is solved. The banks in the South Level will continue to subside as the peat shrinks; but because they are being remodelled with imported clay where the local material is inadequate, and the rate of subsidence decreases with time, it will not be necessary to raise them again for several decades. Neither the relief channel nor the cut-off channel runs through soils subject to shrinkage.

The relief channel is eleven miles long and has a bed width varying between 175 and 200 feet. Some twelve million cubic yards of spoil have been excavated, and five road bridges and a railway bridge have been built across it. The Tidal River banks have been raised and strengthened to give protection against a repetition of the fatal tidal surge of 1953, and set back in places to straighten and improve the cross-sectional area of the river. The internal drainage in the neighbourhood of the relief channel has had to be entirely remodelled.

Strengthening the banks

Although the soils in the silt area do not shrink like the peat, some of them have little strength. In the buttery clay it was necessary to use bank slopes as flat as four and five to one at the lower end of the relief channel, and the abutments and wing walls of the tail sluice had to be constructed on the existing ground and sunk to the required level, like wells. Even the excavated spoil did not stand as high and as steep as expected, and extra land had to be bought to accommodate it.

Where they are liable to erosion, the banks of the channels are being protected by stone pitching and, below low water level, by willow and brushwood mattresses. Such mattresses have been used on the Ouse for many years, and are common in Holland. Essentially they consist of a sandwich of reeds and brushwood, laid between two grids formed of "cables" about

twelve inches in circumference, called wieps, and made of osiers or hazel. Mattresses are usually built on dry land, launched into the river and towed to the site, where they are sunk by placing stone on top of them from barges. The willow and brushwood are grown locally, much of it in holts owned by the River Board.

The cut-off channel will vary in bed width between fourteen feet at its upper end and seventy feet towards Denver. It will pass underneath the Little Ouse and the Wissey in reinforced concrete syphons, with connecting channels and sluices to allow upland water to be diverted into it at will. Sluices across the two tributaries will control the flow to the Ten Mile and Ely Ouse Rivers. The channel will be crossed by twenty-seven road and three railway bridges.

Some two million cubic yards are being dredged out of the Ely Ouse and Ten Mile rivers, and setting back the banks to straighten the rivers has involved the construction of several new lengths of public road. One bridge has been completely rebuilt, and the foundations of seven others are being protected in connection with the deepening of the rivers.

Drainage versus navigation

Even in the days of the Adventurers there was a conflict of interest between drainage and navigation, and it was no surprise that the harbour authority at King's Lynn was concerned for the safety of its shipping channels. In the Act under which the Flood Protection Scheme is being carried out, Parliament inserted a protective clause, by which the River Board has to carry out such works as the King's Lynn Conservancy may require for the prevention of shoaling and erosion in the shipping approaches, and in any case to make good any damage that the operation of the scheme may cause. To this end, a barrier wall has been constructed in the Wash to prevent the shipping channel from opening up to the west, and the present western training wall has been raised at its northern end and is to be further extended by some two thousand feet.

The total cost of the Flood Protection Scheme will be about £10 million, a sum that would bankrupt the River Board. But under the Land Drainage Act of 1930 the Minister of Agriculture is empowered to make grants towards new works and improvements, and the Exchequer is paying ninety per cent of the cost. In the context of history, geography and economics there can be no doubt that so massive an undertaking should be largely a national concern.

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Distribution of Horticultural Output in England and Wales

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The general pattern of our horticultural production is not particularly well known, and there are some surprises, especially in the details. Mr. Hinton reveals, for instance, that fruit production is more intensive in East Anglia than in the south east.

COMMERCIAL horticulture is found where the influences of soil and climate combine with that of the market to make production economic. In England and Wales horticultural production is found in a few well-defined areas, shown in Fig. 1. The shaded parts contain only half our acreage of crops and grass, but together they produce eighty-six per cent of the total horticultural output.

The products included in this examination of distribution are vegetables, fruit, flowers and glasshouse produce; hops and potatoes are considered as farm crops and so are omitted. County boundaries have been made the boundaries of each area, although only certain parts of a county may be horticulturally important; and adjacent counties have been included, even if not strong horticulturally, where they combine to make a well-known geographical area; for example, the Atlantic peninsula of Cornwall, Devon and Somerset. Values of horticultural output have been built up from the acreage figures, with allowance for double cropping, and the values of separate crops in 1958. Examples covering a wide range of crop output per acre are: carrots £96, Brussels sprouts £140, strawberries £216, and tomatoes (heated) £4,835.

The regions compared

The area of most intense production, south-east England, owes its pride of place substantially to fruit. Most of this is produced in Kent, which is especially favoured for fruit production, having the most suitable climate and soils as well as being adjacent to London, through which flows over half our domestic trade in fruit and vegetables. Developments in transport have led to the expansion of horticulture here, witness the recent development of fruit production and market gardening east of Canterbury. Ranking next in importance in the output of the south east is glasshouse production, half of which is concentrated in West Sussex around Worthing. The siting of glasshouse enterprises depends less upon soils and more upon light intensity. Worthing enjoys the highest light intensity in the country; and this, together with the excellent transport communications to London, accounts for the great importance of glasshouse produce there.

East Anglia produces about half of our home-grown vegetables, glass-

* Since this article was written, Mr. Hinton has joined the School of Agriculture, Cambridge University, as Horticultural Liaison Officer.

Fig. 1.

house produce, soft fruit and flowers. Its pattern of production is closely similar to the national pattern. Vegetable production is particularly favoured by the relatively mild and dry climate and the presence of free-working soils. Like the south east, East Anglia lies close to the London market, and is well placed for the markets of the industrial north and the Midlands. Most of the bulb flowers are produced in Lincolnshire (Holland), while the counties of Norfolk, Ely and Essex account for most of the soft fruit. The establishment of processing plant at such centres as Wisbech and King's Lynn has given wider outlets for soft fruit and vegetables in this district. Most of the East Anglian (including Middlesex) glasshouse production comes from the Lea Valley, only fifteen miles from London. Production here originated in the days of horse transport, and today, when this advantage has lost force, one-third of the glass in the country is still concentrated in this area.

The horticultural production of the west Midlands is made up almost entirely of fruit and vegetables. Glasshouse crops and flowers together account for only one-tenth of the output from this region. Both fruit and vegetable production have been long established here. The Vale of Evesham vegetable area did not gain its present importance until the break-up of farms after the agricultural depression, but it now grows nearly one-fifth of the fruit and one-tenth of the vegetables. For the west Midlands, market alternatives are greater than for any other horticultural region. Good outlets for fresh produce are available in the Black Country, South Wales and London. One-third of the cider apples and virtually all the perry pears are produced in this area. The production of vintage fruit here, like that of the soft fruit industry around Wisbech, has been stimulated by the growth of local processing firms.

The south west is the most remote of our horticultural regions, and it has the smallest output. Horticultural production here is largely based on the very mild climate, which so favours the production of early produce as to make it competitive despite the long haul to the market. Over the area as a whole, vegetables, fruit and flowers are of almost equal importance. Most of the flowers and vegetables, however, are produced in Cornwall, while Devon and Somerset produce almost all the fruit and glasshouse crops. Though over half our cider fruit is

grown here, market apples and pears account for most of the fruit output.

Two-thirds of the horticultural output of the northern region is of open ground vegetables, most of which are grown in Lancashire and west Yorkshire. Glasshouse production, which is of great significance here, accounts for one-quarter of the total output of the region, or as much as one-tenth of our total glasshouse production. Within the area, Lancashire is the biggest producer of glasshouse produce, followed by east Yorkshire. Of all the regions, the north is least favoured by natural conditions for the production of horticultural crops; and growers in this area have shown great ingenuity in adapting their local situation to take advantage of the big markets in their midst. Their use of cold glass is an example of this.

Value and intensity of production

The composition of the total horticultural output of England and Wales, together with comparisons of the separate regions' contributions, is given in

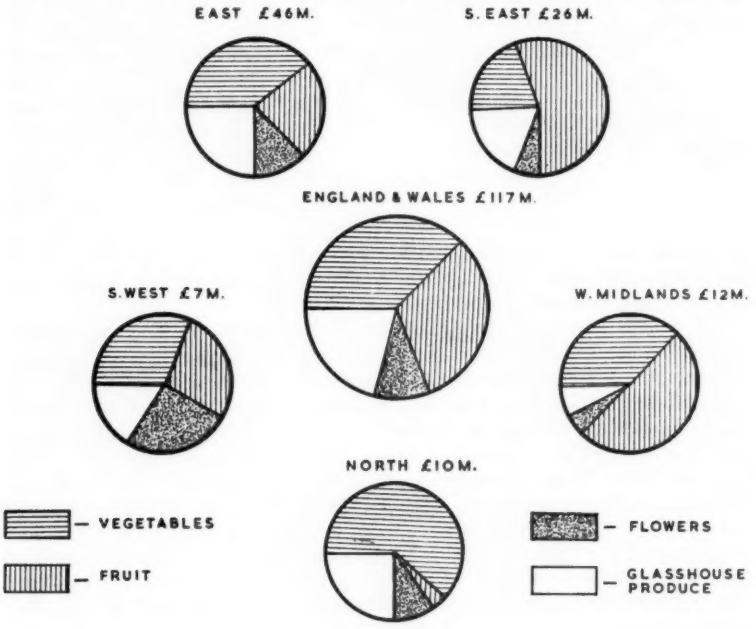

Fig. 2.

Fig. 2. In 1958 the total farm gate value of horticultural produce grown in England and Wales was £117m. Fruit and vegetables alone accounted for £80m, vegetable output being rather more than one-third of the total and fruit output rather less. Glasshouse production, including all vegetables, fruit and flowers grown under glass, contributed one-fifth of the output, and flowers one-tenth.

The value of the horticultural output produced by any one area depends

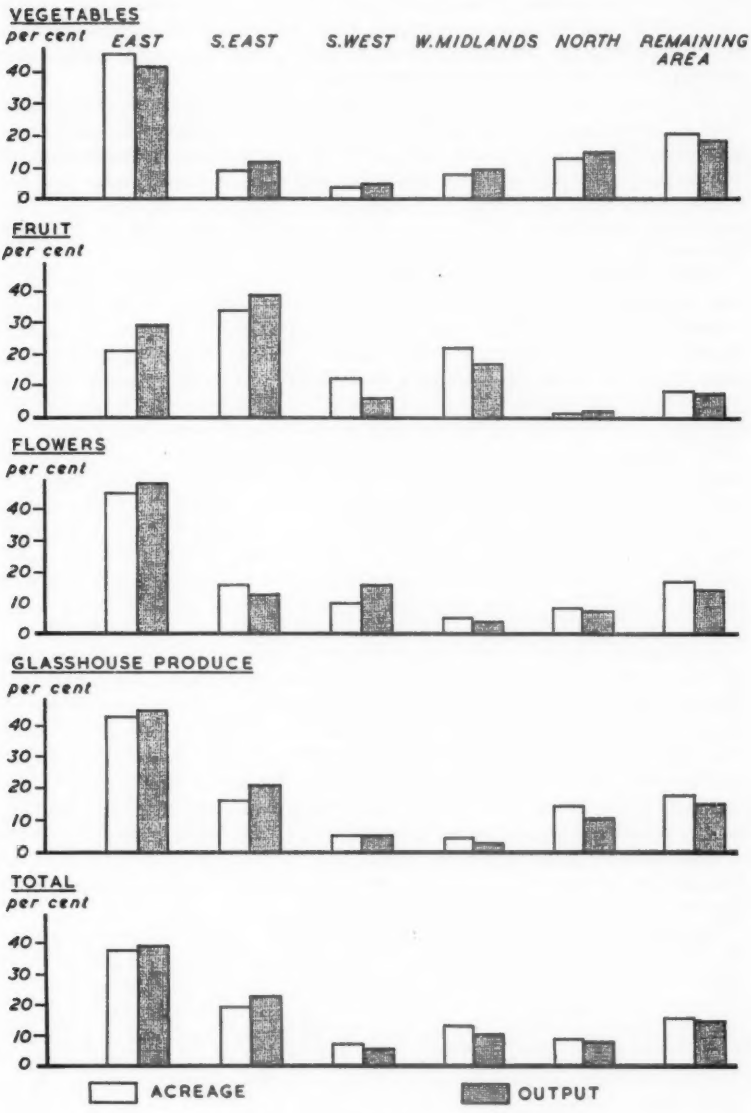
VEGETABLES
per cent
EAST
S.EAST
S.WEST
W.MIDLANDS
NORTH
REMAINING AREA
40
30
20
10
0
FRUIT
per cent
FLOWERS
per cent
GLASSHOUSE PRODUCE
per cent
TOTAL
per cent
ACREAGE
OUTPUT

Fig. 3.

on the acreage of crops grown and on the sale values of those crops. Fig. 3 (on p. 187) shows the proportion of our total output of vegetables, fruit, flowers and glasshouse produce, alongside the proportion of the total acreage occupied by the crops in each region. Crop production of highest intensity is shown where the shaded columns are higher than the white, while lower intensity is indicated where the reverse occurs.

The relative intensity of regional output based on output per acre of total land in horticultural use (Fig. 3) is different from that based on total crops and grass (Fig. 1). The south east and East Anglia have the same order of importance according to either basis, but per acre of horticultural land the northern region ranks next in importance to these areas, and the west Midlands becomes the least intensive area. This situation reflects the composition of horticultural output in each region.

Thus vegetable output in East Anglia, as one would expect, is less intensive than in the other areas. This is associated with low cost farm scale vegetable production. What may be more surprising, however, is that fruit production in East Anglia is more intensive than in the south east. This is because so much of East Anglia's fruit production is of "dessert" quality. East Anglia has half the soft fruit (value £245 per acre) and a quarter of the top fruit. Most of the top fruit is dessert apples and pears (worth £240 per acre) and the rest, only 16 per cent, is culinary fruit (value £95 per acre). The south east grows one quarter of our soft fruit and about half our top fruit, but low value cooking apples amount to one-half of the top fruit acreage, so depressing the value. The fruit output of the west Midlands is very mixed. One-quarter of our black currants are grown here (worth £290 per acre), but orchard fruit, heavily weighted by cider apples, combines with soft fruit to give low intensity. Output per acre is much lower in the south west, where cider apples (£22 per acre) dominate the fruit values.

The outdoor flower output does not include bulbs as such, or a proportion of other plants sold during the year. This produce is considered not to have left the national farm. Flower production included in the output is greatly influenced by bulbs for sale as flowers and flowers grown in the open, which together account for about three-quarters of the flower output. East Anglia and the south west are the areas of most intensive flower production. Output per acre is low in the south east because other plants of lower value (nursery stock) feature prominently in the production. The near monopoly of the flower trade by growers in East Anglia and the south west, despite the local production advantages which they enjoy, does lead one to wonder whether the other regions could not grow more flowers to their own profit.

One-third of the glasshouse output comes from the production of flowers. Apart from a very small amount of fruit, vegetables make up the rest. The pattern of output for each area more closely resembles the distribution of heated glass than that of the total glass area. In the east, however, glass is used less intensively, while in the west Midlands and the north in particular, glass is used more intensively than the distribution of heated glass suggests. The highest output per acre of glass, achieved by the south east, is due in part to the high proportion of flowers grown there. The north grows more glasshouse vegetables (£6,300 per acre) and the east has most of the cucumbers and tomatoes (£9,700 and £4,835 output per acre respectively).

Celery Growing in the Fens

K. M. ROUND

County Horticultural Officer, Isle of Ely

Celery growing is becoming increasingly an extensive farmer's crop, but raising the young plants—a separate industry in the Fens—is a very intensive business. Grower and raiser both benefit from being specialized.

NOT many people realize that 70 per cent of the acreage of celery in England and Wales is grown within fifteen miles of the towns of Ely and Littleport. In all, some 4,000 acres are grown on the black fens in the counties of the Isle of Ely, Norfolk, West Suffolk, Cambridgeshire and Huntingdonshire.

One remarkable feature of this very important fenland industry is that most of the plants—about 80 million annually—are raised under contract by some thirty glasshouse growers living within a mile or two of Whittlesey, which is about twenty-five miles from the main ware crop producing area of the southern fens. It is a small town on the western edge of the fenland a few miles from Peterborough. Brickmaking is its main industry, the dry workings for the raw material, Oxford Clay, being a feature of the landscape there and often eighty to one hundred feet deep at the clay face.

The overburden to the clay is a deep loamy gravel admixture which, because of its efficient drainage into the nearby clay workings, favours early soil preparation for the pricking out of the seedlings in March and April.

The seed is sown in boxes in heated glasshouses from 14th February onwards, the thickness of sowing depending on previous germination tests. The aim is to produce 4,000 seedlings to each seedbox measuring 15×20 inches. The seed is previously hot-water treated at 122°F for twenty-five minutes against the seed-borne disease leaf spot (*Septoria apii-graveolentis*). For the last three years this service has been carried out by the N.A.A.S. Regional Plant Pathologists at Cambridge, an average of 400 lb of seed being treated annually. While the complete eradication of the disease that was achieved by the same method in Lancashire[1, 2] has not occurred in the Fens, there is no doubt that leaf spot has been greatly reduced by the mass treatment sponsored by the N.A.A.S.[3]

Pricking out starts at the end of March

The composts used are usually light and free draining, but only a few growers use the John Innes types. There is some interest in the University of California type mixes. Formaldehyde and steam are used for soil sterilization but, in spite of this, damping off is occasionally severe during periods of dull rainy weather. The earliest seedlings are hardened off in cold frames from mid March for pricking out, which usually starts at the end of that month. Beds, protected from the wind by tall privet hedges, are marked out six feet wide and are firmed, levelled and raked. Narrow paths a foot wide divide the beds. Two women, each kneeling in a potato tray, prick out in each bed. The potato tray avoids disturbance of the levels, and if built up at the front and cushioned makes this tedious job more comfortable. The plants are pricked out approximately 1×1½ inches apart, and the skilled women

average about 10,000 to 15,000 plants a day or 2,000 an hour, for which the piece rate is 3*s*. 6*d*. a thousand. At least one exceptionally deft woman has been known to prick out 36,000 during a long day! This work goes on until the middle of May, and overhead irrigation is given as necessary in dry weather as the work proceeds. Mobile glasshouse structures, of which there are now five acres in the area, are used for the pricking out of the first batches. They also allow the work to proceed unhindered during periods of inclement weather.

As far as possible, the self-bleaching celery (which is sown last, at about the middle of March) is pricked out under glass, as it is lifted first—from mid May onwards. The women who pricked out the seedlings also lift and count the plants for dispatch to the farmer. Normally they are packed 4,000 to a potato tray. This process goes on until well into June. The average price per thousand at the farm is 20*s*.

It is often asked why the Fen farmer does not prick out his own plants, or sow thinly in frames as his Lancashire Mossland counterpart does. The answer is that celery plant raising is a specialist job, calling for traditional skills, considerable organization, available skilled labour and glasshouse or frame space. An efficient industry has grown up in Whittlesey, meeting all the Fen farmer's requirements at a competitive price, thus leaving him free to deal with the hundred-and-one other tasks to be found on every farm. As no pricking out is practised in Lancashire, the seedlings at planting time are very small. In their wet, humid conditions they grow well, but in the Fens the same sized seedlings would quickly shrivel up in the searing winds and dry weather we usually experience in June.

Planting out the ware crop

The land usually chosen for planting out the ware crop is a deep peat—becoming increasingly hard to find as, indeed, is farmyard manure which, when obtainable, is ploughed under during the autumn at 10–20 tons per acre. Experiments conducted by the N.A.A.S. in the Eastern Region have shown that nitrogen applications reduced yield on light peat fenlands.[4] These trials have also shown that 5 cwt per acre of agricultural salt applied broadcast at least a month before planting, and 5 cwt superphosphate and 5 cwt muriate of potash applied broadcast before planting, have increased yields. Kainit at 10–12 cwt an acre, broadcast at least one month before planting, may replace the salt and potash if desired, while a further alternative would be 12 cwt per acre of 0–7–25 if such a compound was manufactured.

Planting is now almost entirely carried out by machine, the peak period being early June. A team of four and a tractor driver can plant 10,000 plants an hour. Distances between the rows vary considerably, but 4½ feet is common. Space between the plants in the row is usually about 5 inches. Experiments[5] have shown that heavier, better quality sticks are obtained at wider spacing of 6 and 7½ inches, but market intelligence tends to indicate that whilst slightly better prices are obtained for the big heads, the gross return per acre for the normal 4½–5 inches spacing is greater.

Earthing up is carried out by specially constructed celery moulders. There is an increasing tendency for celery to become an extensive farmer's crop, especially as high-clearance tractors and twin moulders are available, with

Skilled workers prick out 10–15,000 celery plants a day, approximately $1 \times 1\frac{1}{2}$ inches apart . . .

Reproduced by kind permission of S. T. Burdett

. . . a meticulous and backaching job.

Celery Growing in the Fens (Article on pp. 189–91)

Photo: *K. M. Round*

Seed is sown in boxes in heated glasshouses from mid-February onwards. Each seedbox, 15×20 inches, contains about 4,000 seedlings.

Photo: *Jack Branch (Sales) Ltd*

Earthing up is carried out by specially constructed celery moulders.

Photos: *John L. Jones*

(*Left*) Mr. P. Young's portable shearing installation set up under a Dutch barn. (*Right*) The sheep walks the catcher back to the shearing board.

Photos: *John L. Jones*

(*Left*) For fast and less tiring shearing, the cable should be held clear of the deck. (*Right*) The catching pen is always brushed down with a stiff brush between batches.

Flood Protection on the Great Ouse Article on pp. 178–83)

The head sluice at Denver (right) nearing completion. On the left is the old Denver sluice.

Photos: *Lynn News and Advertiser*

Dredgers removing the last of the mud near the new tail sluice (by King's Lynn). This will give water released from the relief channel free access to the tidal section of the River Ouse.

Flood Protection on the Great Ouse Article on pp. 178–83)

Two views of the tail sluice. In the photograph above, the sluice gates are opened for the first time.

Photos: *Lynn News and Advertiser*

A Tiger Moth being quickly refilled with fertilizer for top dressing, and (below) top-dressing grass after a forage harvester has taken a silage cut.

Photos: *Eagle Photos*

Aircraft in Agriculture (Article on pp. 203–6)

Spraying Brussels sprouts by helicopter against mealy cabbage aphid near Baldock.

Photos: *Fisons Pest Control Ltd*

A large acreage of potatoes being sprayed against potato blight.

which a tractor driver can mould up to twenty acres in a day. It is, of course, important to time the mouldings (varying from one to three) according to the anticipated marketing date and the state of the weather, bearing in mind that no pink frost-resistant varieties are now grown in the Fens. Usually a period of twenty days between moulding and marketing is desirable, but this varies with soil and variety.

A considerable acreage of self-bleaching celery is still grown in the Fens, but is declining because of the toughness and stringiness of these varieties—wherever they are grown. They have the advantage of being early, but do much harm to the industry in that the poor quality puts purchasers against the later, good quality varieties. Self-bleaching varieties are planted in 28-inch rows, and earthed up before sale.

The chief non self-bleaching variety grown is Clucas New Dwarf White, both for early and maincrop purposes. It is delicious, and disposes of the fallacy that celery needs frost to improve the flavour. It is also extremely brittle, which, while adding to its attractiveness, means that it has to be marketed in boxes. Marketing of this variety starts by the middle of September, but peak loadings take place during late October, November and early December. There is usually very little celery left by Christmas.

Wareing's Dwarf White is the latest variety grown, but its popularity has shrunk considerably because it does not now resemble the variety which was introduced under that name, being very uneven in growth and quality. Clucas Cambridge White will probably replace it.

With the increasing use of boxes instead of rolls, marketing methods have improved. Most celery is still sold dirty in returnable bushel boxes (each holding 14–20 heads) although a few prepackers have begun operations in the last few years, and there is increasing use of non-returnable boxes and considerable interest in washing machinery. One prepacker hydrocools all his celery. The N.A.A.S. Celery Demonstration in 1959 at Littleport gave much attention to all these facets, and another outcome has been the proposal to form a Celery Growers' Association in the area, which would organize an appropriate advertising and press publicity campaign for celery.

Increasing quantities are being canned or used both in canned and dehydrated soups. The revolution in washing, hydrocooling and packaging, and the likely decline in the number of shops and stalls selling dirty vegetables in favour of canned goods and frozen foods, are factors which celery growers are facing and alive to. Celery is a comparatively expensive crop to grow, and costs between £120 and £150 an acre, the figure depending largely on the number of copper based sprays or dusts necessary for leaf spot control. Growers cannot afford to lag behind in the new conception of efficient marketing, the main requirement being a clean, well graded article with a guaranteed continuity of supply between October and the new year.

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Presentation of Potatoes for Market

J. E. Piccaver

Spalding, Lincs

The home potato-grower may be giving his market away to foreign competition, says Mr. Piccaver, but he can win back the lost ground, and more, if he will only present his product to the housewife in a more attractive way.

Of all the seasons in which potatoes have been marketed, the one now finishing has been about the worst. In many cases through no fault of the producer, but just because of the bad season, a large part of the crop has not been dressable. The consumer resistance to these poorly presented potatoes must be a real object-lesson for the future, which must be learned if we are to retain our own market and not hand it to foreign competition on a plate.

Why the preference for Redskins and King Edwards, to the degree which has been experienced these last two seasons? What size and quality does the housewife want? We have now had experience of bigger riddles: how big does she want them? It is pretty certain that a 2-inch riddle has proved too big, and equally certain that 1½ inches was too small. The time has come, I feel, when our samples must be graded to uniform sizes, say small, medium and large, with perhaps a maximum top riddle of 3 or 3¼ inches. There are uses for these different sizes of potato, but mechanical cleaning and peeling require a uniformity not previously thought necessary.

Potatoes must be clean, and free from stones. Looking around at markets I am horrified by what some producers consider fit to offer the housewife. Merchants who accept such standards are equally to blame, and should not be tolerated any more than a shopkeeper who tries to sell bad food.

Once again quality is coming back into its own—not only in appearance, but as cooking quality, the lack of which has played quite an important part in this season's sales. As producers, we must bend to consumer preference. The striking difference between Red and White prices shows the value of quality, especially in a commodity such as potatoes which can be overproduced so easily. Unfortunately the acreage of the better quality varieties has been considerably reduced during the past few seasons, and there is a widespread tendency to produce not quality but bulk. Merchants could do much more by closer personal supervision of what they buy on the farm. Once bad produce is marketed the damage is done.

Prepacking has endeavoured to remedy the ills of bad dressing and presentation. To begin with this was achieved, especially when potatoes came out of the clamp dirty. A cleaning process then was of real value. There followed a season when prices were very high, and it became impossible to pay a premium for the better-dressed samples for prepacking; and last season the condition of the crop did not permit washing or cleaning for presentation. During these unfavourable seasons, there has been an increasing percentage of badly-presented potatoes in prepack—any old thing to demand a higher price—and without doubt prepacking has suffered a severe rebuff.

When the early potato season starts here at home, considerable quantities of Channel Island potatoes have already been sold, and many are still on sale. Usually they are well presented, uniform and clean. Our producers and merchants then place before the British housewife our first early crop—some well presented, but so very often (and especially in wet weather) with many samples dirty, small and variable—which bear a "home grown" label to help sell them.

Use the riddle much earlier

Efforts are being made through the Potato Marketing Board's Early Potato Committee to improve the presentation of earlies. It may be necessary to use a riddle much earlier than in the past, to prevent excess soil, etc., from leaving the farm; without this restriction each year many tons of early potatoes reach markets without ever having been on a riddle at all. I know the immediate reaction to this sort of suggestion by some producers would be that riddling would ruffle the skin, but this need not be the case. In many areas the practice of picking into wire baskets almost achieves the object of riddling: a prescribed riddle would bring in those who do not bother, and a sample 100 per cent cleaner would start off from the farm.

Four months of the year are as a rule open to direct marketing from the field; five if the weather conditions permit from June to October. Often much harm is done by ignoring the elementary principles of marketing during this time. For every well dressed and presented sample which goes on to the market or is offered to the housewife, two or three bad ones follow.

This state of affairs can then run on into the maincrop season. If farmers will not try to correct these points, we must appeal to the trade—who buy them—not to accept samples which are unpresentable to the public. And the housewife should not entertain bad and dirty potatoes in her purchase. We know from experience over the last two or three seasons that the public will readily pay 3½*d.*–5*d.* a lb for maincrop potatoes if the sample is good and well presented. Consumption maintains a steady run at these prices, but when prices drop and samples suffer, down it comes, with all the consequent reactions to the grower and market as a whole.

I think it true to say that consumption drops *after* the price has fallen, not that the price falls because consumption drops.

In the marketing of our main crop, perhaps the biggest difficulty is in presenting samples free from mechanical damage, especially when dry conditions prevail at lifting time. The more mechanized our lifting operations become, the more the risk of this fault. Another major problem in a dry season is the avoidance of scab. The public have missed a lot of very good quality from the cooking angle this season because they would not buy a scabby potato. I do not advocate scabby potatoes either—but they usually cook very well.

Yet another feature to be borne in mind is the ever-increasing use being made of mechanical potato peelers. These, as is well known, do not remove a fault below the skin—and mechanical damage, for instance, is often not more than a mark about ⅛-inch under the skin—which peeled the old way would have come off.

All these developments mean that a higher standard of dressing and more

careful handling are needed. I mentioned prepacking earlier in this article: very considerable progress has taken place in this line with potatoes, but the less careful packer has checked it by prepacking any old sample he can purchase at a low price and offering it under some fancy label as a top grade article. Most merchants are prepared to pay a premium for really well-dressed potatoes of the desired quality. This must be the right approach; it helps to cut down on prepack rejects, which can become a real danger to the general ware potato trade by finding their way back on to the market at cut rates.

Door-to-door service

A service direct to the consumer's door will develop from prepacking. Already the size of pack seems to have settled down at the normal household's weekly requirement, and delivery direct from packer to consumer is spreading. For this to continue the housewife must be sure she will get the quality and type of potato she wants, and the merchant must have a supply of the right potatoes guaranteed throughout the season. This leads on to growing on contract, or on a contract basis for specific jobs—much as "Records" are grown for crisping. The potato being such an expensive crop to grow, any assurance of a fair return should, I would think, be welcomed by genuine potato growers, and this system, with certain modifications, offers that prospect.

What do these observations add up to? Simply that we have in the potato a perishable commodity which the housewife requires throughout the year. A commodity for which she is prepared to pay a good price, sufficient to ensure a good return, provided that it will cook well after easy cleaning and peeling, and is presented to her in an attractive way, free from marks, blemishes and damage—as any other foodstuff is sold. Once this is done the demand for imported potatoes should decline, and consumption will climb again to its real and essential level for a crop which is extremely important to our arable farming.

Easy Shearing of a Small Flock

JOHN L. JONES

A portable sheep handling and shearing set-up has been designed and made by Mr. P. Young of College Farm, Cirencester, for use indoors or in the field.

His aim has been to bring the advantages of the shearing shed—clean wool, faster shearing, easy handling and less fatigue—to the smaller flock-owner, for whom the shed is not an economic proposition. Mr. Young's flock numbers 180–200 Border Leicester/Clun crosses. He has worked on a sheep farm in New Zealand, and was chosen by the Wool Marketing Board for a course under Godfrey Bowen.

His basic set-up consists of three holding pens 7 feet square, each holding 10 sheep, a catching pen of 14×7 feet, and a shearing board—also 14×7 feet. The pen floors are of hardwood slats 1½×2 inches on 2-inch timbers. The sides are 2 inches×1 inch.

Sheep pass from one pen to the next through sliding gates which are held closed with a simple catch. The whole outfit is sectional, and the pen sides are simply tied with binder twine and pegged into slots at the base. Added rigidity is provided by uprights and crossbars in the middle and at the top end of the catching pen. The shearing platform, made of heavy planking, is in halves, bolted for easy dismantling and removal.

Mr. Young's shearing routine is streamlined and effort-saving. The woollies for shearing are penned, either overnight or for a few hours in the morning, to make the sheep sweat for ease of shearing. They move, or are shed, up an inclined ramp into the first pen, and move forward without driving until the pens are filled with 50 animals.

The shearing heads are driven from the flywheels of a 20-year-old water-cooled engine mounted on a heavy-wheeled bogie. As this is at balance point, it is jacked for safety. An angle-iron frame built over the top of the engine has enabled Mr. Young to lift his brackets up to 6 feet, which gives him a shearing deck clear of fouling cable.

How it works

To get his woollies to the shearing board, Mr. Young pulls open the spring-loaded gate of the catching pen, enters, and the gate shuts behind him automatically. As the floor of the catching pen slopes up hill, the sheep stand with their backs to the gate and the caught sheep literally walks the catcher back on to the shearing board. Mr. Young himself does the shearing in modified New Zealand style, and his wife rolls the fleeces. As soon as the catching pen is emptied it is brushed down with a stiff brush, and the shearing board is also brushed at frequent intervals.

Shearing in non-slip "cake-bag" moccasins, Mr. Young finds that this combination of labour-saving pens and raised shearing brackets enables him to shear comfortably 60 ewes in a short working day, and he is less tired than he used to be after shearing half that number. He emphasizes the importance of the bracket height as an anti-fatigue factor, and also the use of

near boiling water in the engine hopper to clean the blades, with frequent dipping. Mr. Young, like all experienced shearers, prefers his sheep as hot as possible.

To strip and load the outfit on a low-loading trailer—designed originally for picking up sacked grain from the combine—takes roughly half an hour, and the same time is taken to set it up. In the field the sections have the definite advantages that they can either be "skewed" or fitted at right angles for an awkward field corner, and of course there are no grass pens to get dirty and foul the fleeces.

For the man with about 30 sheep Mr. Young thinks it would still be worth making one holding and a catching pen and the shearing board. The outfit can of course be extended to cater for a thousand sheep, though for 400 upwards the shearing shed is economically advisable. (Indoors the bracket height demands 8 feet headroom.)

Whenever Mr. Young sets up his portable pens—they are used for all sheep handling purposes—he always installs a foot-bath along the exit race for the sheep. The total cost was £60, excluding the engine.

Cattle Yards

PHILIP L. RUSHTON, M.A.(CANTAB.), A.R.I.C.S.
Agricultural Land Service

Siting a cattle yard in the right place saves time and temper. And a good design need cost no more than a bad one; in fact it will cost less in the long run.

THE location of cattle yards is one of the most ignored aspects in the layout of farm buildings. The expensive time-wasting potential of a poor layout is seldom thought about. It is still common for owners to site cattle shelters far away from the Dutch barn, so that everything has to be loaded on to a trailer and carted. They will put mangers at the back of the shelter and cart every bit of food through a yard full of cattle and unwittingly make mucking out as difficult as possible. Sometimes, of course, existing buildings limit the scope for incorporating all the best features into the design of a new yard, but often the obstacles can be overcome by careful planning. This article shows some of the points to consider.

There are two main points to watch about siting. Firstly, the well-known principle that the open part of the yard should face south or south east. The north and east (and sometimes west) sides should be enclosed; the presence of another building on these sides is no guarantee of warmth and freedom from draughts and driving rain or snow. It is surprising how a cold east wind will whip over even a large barn and through the yard.

Secondly, the yard should adjoin the barn where the straw and hay or silage are stored, so avoiding double handling of heavy bulky foods and

straw, which increase the cost but never the value. The simplest layout is a lean-to housing the cattle against a Dutch barn holding straw and hay. Littering is then only a question of throwing bales down into the lean-to, and cutting the string or wire and spreading the straw. Don't forget to remove the string or wire from the yard.

If the number of cattle to be housed is more than one lean-to will accommodate, a free-standing shelter should be built close up to the Dutch barn.

Unlike littering and mucking out, feeding must be a daily job, and good arrangements for feeding will pay most useful dividends by saving labour costs. Avoid ever having to go into the yards to fill mangers. Either have feeding passages along the centre of the yard or have the mangers along the outside.

An adult dehorned beast needs $2\frac{1}{4}$–$2\frac{1}{2}$ feet of trough space, and if necessary the manger space can be increased by making an outside concrete apron with mangers on both sides, as shown in Fig 1.

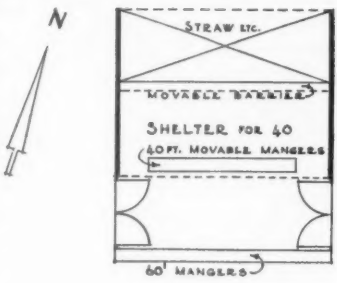

Fig. 1.

If silage is to be fed it will be on either the cut-and-ration or self-feed principle. Whichever way, the silage should be near the mangers, either under the Dutch barn with the straw on top or in a silo next to the yard. (Fig. 2 shows two suitable layouts.)

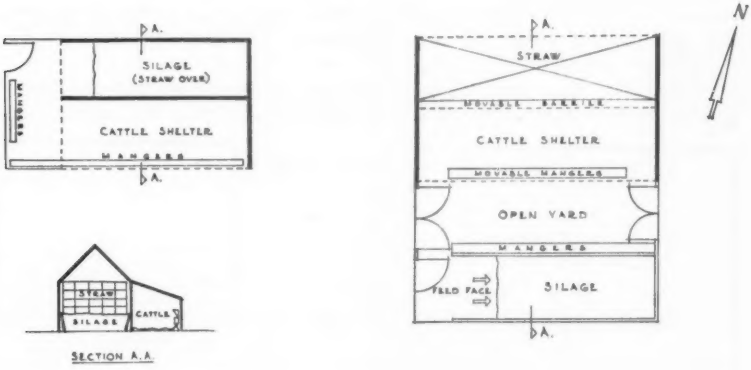

Fig. 2. Two plans which keep the silage where it should be—near the manger.

One final point on feeding. If the yard is for dairy stock, feed in the open and not in the bedded area. Cattle will dung where they eat, and the open-

feeding system reduces fouling of the bedding, so that the cows come into milking much cleaner.

Full or part cover?

Whether to provide full cover, or part cover and an open yard, will largely depend on the individual's preference and pocket. The problem of slurry and its disposal in an unlittered open yard can be acute. Putting a roof on keeps away rain, and once this is done the difficulty is largely solved. The area can then be lightly littered to soak up the dung and urine, though this is not essential given a gully and drain.

It is more expensive to give full cover, of course, but remember that whilst concrete in an open yard is essential this cost can be saved under a covered yard, where a floor of rammed hardcore, chalk or slag is perfectly adequate. The floor of a self-feed silo must, of course, be concrete, whether under cover or not.

On balance, full cover is to be recommended, even in the Eastern Counties where straw is plentiful.

Ease of access and adequate headroom are essential with modern muck-loaders. Therefore, the first essentials are a portal frame building (that is to say, with no trusses or tie-bars), an eaves height of not less than eight feet, a distance between stanchions of not less than fifteen feet, and a clear span without internal piers. After that, ensure complete manoeuvreability by having gates not less than twelve feet wide—or, if mangers form one side, have them movable. If the mangers under the shelter in Figs. 1 and 2 above are removable, the whole of one side is clear for the muck-loader. In this respect a recent development worth watching carefully is a type of construction that gives a cover up to approximately 90×50 feet with only four stanchions—one in each corner.

As has been mentioned, slurry in an open concrete yard is a problem. A yard drain with a straw trap and the concrete sloped to it will help to drain

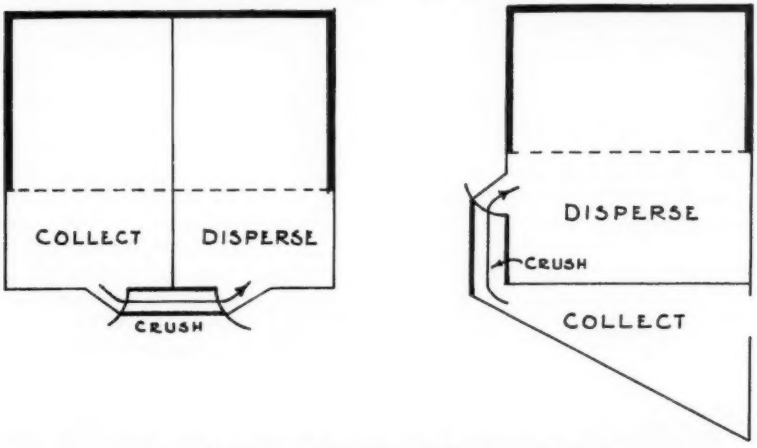

Fig. 3. Alternative layouts for a cattle crush and yards.

off the liquid, but the solids and "soup" will need sweeping to an adjoining apron either with a "squeegee" or a bucket on the front of a tractor, or straw bales on a tractor-mounted fork.

Cattle crush almost essential

A cattle crush is a useful addition to a yard layout, and will save more time (the vet's) and temper (yours in catching the beasts!) than almost any other single item. It can be placed between two yards—one for collection, the other for dispersal—or at one side of a single yard (Fig. 3).

Remember also to put a roof light on the northern slope of each bay in any partly-enclosed yard which is deeper than about thirty feet. Finally do not forget the "bits and pieces"—the need for drainage of the open yard and disposing of the roof water, and a water trough. Electric light under the shelter and a floodlight on the feeding area are most useful.

There's a good deal of money involved in a new cattle shelter, and if at the end all you have got is a "white elephant" in timber, steel or concrete you have wasted your money. A good layout costs no more than a poor one in the first place, and in the long run will cost a great deal less.

★ NEXT MONTH ★

Some articles of outstanding interest

HELPFUL INSECTS *by B. D. Moreton*

PROTECTIVE FLORA OF SEA WALLS *by P. J. O. Trist*

WINTERING THE HILL FLOCK *by J. B. Owen*

FARM MANAGEMENT AND THE BEST USE OF CAPITAL *by W. Harwood Long*

Our Breeding Ewe Population

MOSTYN DUMMER, B.A.

Department of Agricultural Economics, University College of Wales

Mr. Dummer compares the numerical distribution of the breeding ewe population in England and Wales in 1939 and 1959. His figures come from published results of the 4th June returns and the Agricultural Statistics.

IN 1959, the number of breeding ewes in England and Wales at last reached, and in fact exceeded, the total for 1939. In the light of this it has seemed useful to analyse the distribution of breeding ewes in 1939 and 1959, and to consider what changes have taken place between the two years.

In this article the term "breeding ewes" includes two-tooth ewes to be put to the ram in any one year, and the numbers are those given in the 4th June returns.

Table 1

Total number of breeding ewes in England and Wales 1939 and 1959

(thousands)

	1939	1959
England	6172·4	6171·1
Wales	2464·9	2778·1
TOTAL	8637·3	8949·2

Table 1 shows that the numbers of breeding ewes in England in June 1939 and in June 1959 were roughly similar. The increase in the total number in England and Wales for 1959 is due to an extra 313·2 thousand returned for Wales, an amount which represents a rise of 12·7 per cent over the Welsh total in 1939.

The county figures for England and Wales used in this analysis are those given in the Agricultural Statistics. In size the counties vary considerably, and so that they can be compared a common base of 1,000 acres of crops and grass has been adopted. Rough grazing acreages have been left out of account, but this does not materially affect the result.

In both years the same two counties in England and Wales show the highest and lowest numbers of breeding ewes per 1,000 acres of crops and grass. In England the Isle of Ely and Westmorland, with a range of from 14 to 1,068 breeding ewes in 1939, and from 8 to 1,289 breeding ewes in 1959, represent the two extremes. In Wales the extremes are provided by the counties of Pembroke and Merioneth, with a range of from 283 to 2,065 breeding ewes in 1939, and 275 to 3,320 breeding ewes in 1959. These counties comprise, on the one hand, lowland areas with good quality land for crop production, and, on the other, upland areas with considerable amounts of rough grazing suitable only for sheep farming. The interesting point in this context is that the difference between the highest and lowest numbers of breeding ewes per 1,000 acres of crops and grass is much wider in 1959 than it was in 1939.

Change in pattern of distribution

The distribution of the counties in England and Wales, according to the number of breeding ewes per 1,000 acres of crops and grass, is given in Table 2. In 1939, nearly 62 per cent of the counties in England had between 100 and 300 breeding ewes per 1,000 acres of crops and grass, and about 26 per cent had over 300.

Table 2

Distribution of counties in England and Wales by number of breeding ewes per 1,000 acres of crops and grass

	Under 100	100–200	200–300	300–500	500–700	700–900	Over 900
England							
1939	6	17	12	7	3	1	1
1959	15	9	8	10	2	2	1
Wales							
1939	—	—	1	1	3	1	7
1959	—	—	1	2	1	3	6

The distribution in 1959, however, shows a considerable change. By then, nearly 32 per cent of the English counties had under 100 breeding ewes per 1,000 acres of crops and grass, and almost the same percentage had over 300. In Wales, on the other hand, the position was broadly similar to that for 1939, with only three counties revealing any adjustment between the size groups. The numbers of breeding ewes per 1,000 acres of crops and grass in the counties of England and Wales for the years 1939 and 1959 are given in Maps 1 and 2 below.

In Table 3 the counties are grouped into regions; and the proportion of the total ewe population found in each is given for 1939 and 1959, together with the number of breeding ewes per 1,000 acres of crops and grass. The

regions are also shown on Maps 1 and 2. A decrease in the number of breeding ewes per 1,000 acres of crops and grass in 1959, as compared with 1939, is apparent in the eastern, north eastern, and south eastern regions of England. In the eastern region the decline has been general throughout all the counties. In the north eastern region the reduction in the Lindsey and Kesteven divisions of Lincolnshire and in Norfolk has been partially offset by the increase in the East Riding of Yorkshire and the Holland division of Lincolnshire. In the south eastern region, Kent shows a decrease in 1959 as compared with 1939, whereas East Sussex shows an increase between the two years; in all other counties in the region the numbers have declined.

Table 3

Number of breeding ewes per 1,000 acres of crops and grass, and the proportion of the total breeding ewe population found in the agricultural regions of England and Wales, 1939 and 1959

	No. of breeding ewes per 1,000 acres of crops and grass		Tillage acreage per 1,000 acres of crops and grass		Proportion of total breeding ewes in each region	
	1939	1959	1939	1959	1939	1959
					per cent	*per cent*
Eastern	100	62	555	681	3·0	1·8
North eastern	165	137	564	655	5·9	4·8
South eastern	259	220	305	436	6·7	5·7
East midland	243	244	213	372	7·6	7·2
West midland	316	322	195	305	9·8	9·8
South western	314	357	179	214	10·7	12·1
North western	350	383	155	193	11·6	11·6
Northern	490	530	222	317	16·2	16·0
South Wales	748	864	109	138	14·4	15·7
North Wales	1,183	1,399	107	122	14·1	15·3
England	281	282	299	397	100	100
Wales		1,066	108	132		

The proportion of the total number of breeding ewes found in the west and east midland regions in 1959 is similar to that for 1939. In both years the west midland region has had a higher proportion than the east midland. The only county in either region which shows a considerable change from its position in 1939 is Wiltshire, where the numbers have fallen from 187 in 1939 to 82 in 1959.

The remaining regions of England show an increase in numbers. In the south western region the proportion has increased from 10·7 per cent in 1939 to 12·1 per cent in 1959, despite the fall in the number of breeding ewes in Dorset from 211 to 94 per 1,000 acres of crops and grass. The northern and north western regions retain the same proportions as in 1939.

In Wales, five counties—Glamorgan, Carmarthen, Pembroke, Flint and Anglesey—have fewer breeding ewes per 1,000 acres of crops and grass; all the other counties show an increase. The Welsh proportion of the total number of breeding ewes in England and Wales has increased from 28·5 per cent to 31 per cent between 1939 and 1959.

The comparison between 1939 and 1959 may be summed up as follows. If a line is drawn across Map 2 from Dorset to the Holland division of Lincolnshire it will be found that two-thirds of the counties to the south and

east of this line now have less than 100 breeding ewes per 1,000 acres of crops and grass, whereas most of the counties to the north and west of it show an increase in the number of breeding ewes per 1,000 acres of crops and grass.

Greater concentration since 1939

Thus the breeding ewe population in England in 1959, though similar in numbers to that of 1939, shows a greater concentration in areas where, because of physical and climatic factors, grassland predominates and a large amount of rough grazings are found. In Wales there has been a 12·7 per cent increase in the numbers of breeding ewes between 1939 and 1959, and this increase has taken place mainly in Merioneth, Montgomery, Cardigan, Radnor and Brecon. These five counties already contained 48·8 per cent of the Welsh breeding ewe population in 1939, but by 1959 that proportion had increased to 54·5 per cent. On the other hand, the proportion of the total number of breeding ewes in Wales found in the four counties bordering the North Wales coast fell from 26·5 per cent in 1939 to 24·4 in 1959, whilst the proportion in the counties along the South Wales coast fell from 24·7 to 21·1 per cent.

It is not within the scope of this discussion to consider the implications for the future of sheep in England and Wales which may arise from the present distribution of breeding ewes. Many other factors need to be taken into account, chief among them being systems of management and marketing policy. The foregoing analysis only provides a factual basis for further consideration of the problem.

Aircraft in Agriculture

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THE idea of using aircraft for agricultural purposes in this country is at least thirty years old. A spraying contract service started about ten years ago, but only in the last two or three years have aircraft become a not unfamiliar sight in farming. About fifty aircraft are now registered and used in the United Kingdom for agricultural work; the total area treated probably varies from about 150,000 to 250,000 acres a year, according to seasonal demands. This contrasts with more than four million acres in New Zealand, over two million in Australia and seventy million in the U.S.A.

The recent development of aviation in European farming has created its own problems, particularly in the spreading of technical information. To help in this, O.E.E.C. has established a European Agricultural Aviation Centre at The Hague. The conference on agricultural aviation held at Cranfield last September was promoted by this Centre and its director, Dr. W. J. Maan. About 250 people attended, including representatives of twenty-five countries.

What can aircraft do best?

The technique of applying chemicals, including fertilizers, from the air shows little apparent similarity to the application of the same chemical by ground machinery. Many of the technical problems are the same, however, and much of the spray equipment has been developed from that used on ground machines. From the farmer's point of view the most important differences are that aerial application is about twenty times as fast and is unaffected by the height or the spacing of crops, or by the condition of the soil surface. Remote areas, mountains or forests, which ground machinery cannot reach, can still be treated—at a price. Another difference is that the overhead costs of aerial operations are so high that contract work is essential.

Contrary to some earlier opinions, it seems that aerial application of crop protection chemicals can, at its best, give results comparable in efficiency to ground application. Since volume rates have to be extremely low to be economic, it is generally the systemic chemicals which are most successful; but others, insecticides like DDT, and copper fungicides, for example, can be distributed sufficiently well and are commonly used. Those techniques which demand a complete or drenching cover of the crop can usually be done best by high volume ground sprayers. Aircraft can apply volumes of the order of 50 gallons per acre, but at much higher costs.

The speedy operations possible with aircraft are of especial value in enabling large areas to be covered in a very short time. Often this is the main justification for the use of aircraft, which are seldom as cheap in this country at present as ground application. Situations have arisen in the United Kingdom, for example in dealing with the 1958 epidemic of potato blight and again in 1959 with the outbreaks of aphids on sugar beet, when large areas have had to be sprayed in a very few days, following warnings from the advisory services. Where this warning has coincided with prolonged wet weather, making the use of ground machines difficult or impossible, only aircraft can treat the required acreage in time. But the small size of fields, and the scattered distribution of farms in the United Kingdom which at present employ aircraft contractors, prevent full exploitation of the speed with which they can tackle an epidemic. Conditions in many other parts of the world may be markedly more favourable to aircraft; in Canada, a million acres of forest have been sprayed annually for several years to control spruce bud worm, each operation taking about three weeks and using a fleet of some seventy aeroplanes.

On specialized crops, such as orchard fruit and certain seed crops, conventional ground application can be at a disadvantage. It is not easy to get adequate coverage in tall-growing crops such as hops, and the heavy sprayers needed to achieve the best results may damage soil structure.

The ability to apply the heaviest concentration of chemical near the *top* rather than the bottom of a tall crop may be technically advantageous in some instances, and for such conditions aircraft may be the most suitable machine. The generally high value of these crops is usually sufficient to cover the currently higher costs of aerial application. Much experimental work is being done on fruit, hops, forest trees and other plantation crops.

From the operator's point of view, however, sound businesses can hardly be built on a very restricted area of highly specialized crops and an occa-

sional epidemic. Further, almost all the work which aircraft can attempt in British farming has to be done between March and August, the heaviest demand falling in June, July and August. Unless operators have the resources to continue their operations abroad, overheads such as depreciation, insurance and the like must be a very heavy charge on each acre sprayed. The "novelty value" of aircraft operations may have helped their early development, but in the long run they must justify themselves on the grounds of cost and efficiency alone.

Widening the field

What are the prospects of increasing the work which aircraft can do in British farming? Spreading nitrogenous fertilizers on winter-sown cereals is more than a possibility; some experience has already been obtained. The advantages of fairly early top-dressing for wheat, in say late March, are becoming increasingly recognized, but at that time of the year farmers are often busy with spring seeding. The use of an aircraft for this work, which clearly can be done cheaply and effectively by ground machinery, can be justified only on the grounds of convenience. A more probable development for aircraft in applying nitrogen lies in very late top-dressing after cereals have begun to ear. Such late top-dressing, impossible by ground machine without excessive crop damage, will increase grain protein content more than yield. If the farmer can be satisfied that an increase in protein of about 2 per cent is worth the cost of aerial application of about 40 units of N, there may be a considerable demand for such a service, and it would have the advantage of coming when the contractor is not usually very busy.

There has been very limited demand for aircraft to apply fertilizer to hill grazing land in this country; this is in marked contrast to New Zealand, where small amounts of phosphatic fertilizer can achieve remarkable improvements, and many million of acres have been so treated. Marginal hill land in the west and north of Britain often requires substantial quantities of lime (which aircraft cannot so far apply economically) before it will respond to other improving treatments.

Many chemicals used for weed control are well suited to aircraft application on all grounds except the danger of drift. This is a very real hazard, not merely from small droplets drifting down wind but from failure to cut off the spraying mechanism accurately and precisely at the field boundary. Few operators would willingly risk the almost inevitable claims for damage of crops on neighbouring fields or farms. There is scope for research work to minimize the risks of drift from aerial spraying, possibly by new formulations such as the so-called invert emulsions, but the problem of failure to cut off the spray accurately is likely to be much more difficult. Even if these problems were solved, there might not be a big demand for this service on arable crops, because many arable farmers own a low volume sprayer. On the other hand, the aerial spraying of bracken-infested land may be possible if recent good results are confirmed, provided the cost per acre can be justified in relation to the value of the land being treated.

One of the basic problems is cost. The use of helicopters and specially designed fixed wing aircraft may help efficiency, but the high initial price of such machines increases overhead costs. Many of the aircraft at present in

use are therefore secondhand, converted from some other use. A lengthy operating season would be necessary to justify the use of costly new aircraft.

Forward contracting would help the organization of aircraft operation, as also would the arrangement of crops in blocks, so that several adjacent fields could be sprayed together. This would simplify spraying—provided there were not too many hazards in the form of pylons, telegraph poles and the like!

So far, agricultural aviation has been developed as much on a basis of experience as on lengthy research; many operators have not the resources, nor the time in the limited working season, for the thorough and expensive development work which alone can provide a sound technical and economic basis for the future. The industry can develop only if both farmers and operators are satisfied by the financial results.

Paddock Grazing

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Good grassland management is largely a matter of using the system best suited to the time of year. Paddock grazing is especially attractive during the main grazing season, as it uses little labour at this time.

THE essence of successful grassland management is control; not allowing pasture plants to grow away to the flowering stage, and not allowing the animal to graze continuously over the same piece of ground. The ideal is for the pasture to be grazed down quickly, or the herbage cut (and removed as soon as possible) and then rested before it is defoliated again.

Controlled grazing is not a new idea, but in recent years a number of methods of applying control have been developed, and a number of terms have been used to describe them. There is some confusion because of a lack of definition of the precise meaning of the terms used. I shall consider three examples only—rotational grazing, strip grazing and paddock grazing. All are based on the same principle of "on-and-off" management: the difference in these methods lies in the duration of the grazing period and the density of stocking used. (Density of grazing is the concentration of animals at each grazing, and should not be confused with the overall rate of stocking.)

Rotational grazing as we generally define it in this country is the least intensive method, and implies the grazing of several fields in turn for periods each of one to three weeks, shutting up fields for cutting as and when required, or grazing again after a suitable rest period. The density of stocking is generally below ten cows, or their equivalent, per acre. Strip grazing is the closest form of control, excluding cutting and carrying the crop to the animals. Electric fences are used to control the grazing animals, a fresh strip of grass being made available each day or half day. The density of stocking depends on local conditions and season, and may vary from fifty to eighty

cows, or their equivalent, per acre. A back fence may or may not be used, depending on the amount of control required. Paddock grazing may be taken as intermediate between these two extreme forms of control. The density of stocking is about twenty-five cows per acre, and the stock remain in each paddock for one to three days.

There are many variations of paddock grazing which can be used to suit the particular requirements of the farm. It may be desirable to graze the calves ahead of the dairy herd, as is recommended in New Zealand. Alternatively, the cows may graze a paddock for one day, selecting the more nutritious herbage, and be followed by yearlings which will eat the pasture down. With a rotational grazing system as defined above, the animals can gorge themselves during the first few days but, as the period of grazing increases and the amount of leafy herbage declines, intake and production will fall. This is particularly noticeable with dairy cows, where rotational grazing can lead to fluctuating and quickly declining milk yields. If the cows remain for only one day on a paddock with a good supply of herbage from which to select, milk yields will not fluctuate to the same extent, and the decline in output will not be so fast. It is essential, however, to remove excess herbage if the pasture output is to be maintained. Another alternative to following with less productive stock is to use the forage harvester to clear up. The herbage so obtained may be conserved as silage.

Efficient control of the stock is impossible with inadequate sub-division for the size of the herd, carrying capacity of the grassland and topography of the farm. If our fields were square or rectangular, and on level ground with buildings conveniently situated, sub-division for paddock grazing would be easy. Fields can be sub-divided into small paddocks with semi-permanent fencing, but electric fencing is generally adequate, although an electrified barbed wire may be needed if young stock are to be used as followers. In planning the sub-division three main factors must be considered.

Water must be available, and accessible from each paddock. Where there is a piped supply, the movable water bowl or small tank on a length of polythene pipe provides the solution: it may be worth going to some expense to provide it.

With a milking herd, direct access to the milking shed by a race at least 15 feet wide is required. If this runs along one side of the field, damage due to poaching can easily be made good, and an opening to each paddock can be provided by a gate which may be swung across to close the race and allow easy stock movement.

There must be enough paddocks of a size which allows the best control of herbage. The number of paddocks is important, for if too few are allowed there will be no flexibility and the system may become no better than continuous grazing. Rest periods need to be varied in order to provide young nutritious herbage at different times of the year. Voisin* has indicated that in Normandy, to provide grass six inches high, from 25 to 30 days' rest is required in April, 14 to 18 days in May, and lengthening rest periods through June and July. As the season progresses, it is also essential that the density of stocking is reduced, to allow a similar amount of selection to that given in spring. If it is *not* reduced, animals are forced to graze on soiled areas, and

* Grassland Management in Northern France. A. Voisin. *J. Brit. Grassl. Soc.*, 1957, **12**, 150–155.

their intake and consequent production will fall. Soiling can of course be reduced by alternating cuts and grazing periods.

To determine the number of paddocks, the farmer must decide upon the longest duration of rest periods during the season; the density of grazing, particularly in the later summer if the same paddocks are being used; and the length of stay of the animals. The density of grazing and the length of stay must allow for the different classes of animals, if a system involving followers is adopted. Obviously there will be too many paddocks during peak periods of growth, and a number will have to be removed from the grazing rotation and cut for conservation. For this reason it is better for the paddocks not to be smaller than half an acre, and as regular in shape as possible.

Paddock grazing in the grassland system

A large number of experiments have been made throughout the world to compare grazing methods. The resulting evidence points to the need for using the management system best suited to the time of year. Paddock grazing is particularly attractive during the main grazing season, as fences can be set up in advance, leaving the farm labour free to help with conserving winter fodder. Strip grazing is valuable at times when herbage must be used more completely, and is the best method to use for early bite and for dry period grazing on lucerne/grass swards should this be necessary.

Early bite can be provided by a field of Italian ryegrass, or by a long ley of tall fescue/white clover. These could be strip grazed early in the season, and could either be cut in late June or early July or grazed, possibly with another class of stock—sheep, for example. Hard grazing of tall fescue swards through the summer is particularly recommended, as this species becomes very coarse if allowed to age. Paddock grazing could be used from late April, and would continue right through the summer in wetter areas, using for preference permanent grass or leys based on perennial ryegrass/white clover and timothy/meadow fescue/white clover.

In drier areas, it is advisable to have a field of lucerne available for grazing during July and August. A sowing of lucerne at 6 lb per acre and cocksfoot at 4 lb in alternate drills, 9 to 12 inches apart, is suggested. It may not be required for grazing, but should give a high yield for conservation. Herbage cutting experiments have shown that lucerne needs rest periods of 5 to 6 weeks. With this length of rest, however, digestibility is not high and, although fairly complete utilization is desirable to avoid bloat, the animals should not be forced to eat the woody stalks. These are best removed by a mower after grazing. The strip method, using front and back electric fences, is the most efficient way of controlling grazing on lucerne.

No mention has been made of aids such as the use of fertilizers and irrigation to boost herbage yields. Whether these aids are to be used, and the amounts to be applied, must be decided by the farmer in relation to his general policy. Nitrogenous fertilizer and irrigation should both be applied immediately the paddock has been defoliated to obtain maximum benefit.

Finally it must be stressed that a system of grassland management cannot be laid down and followed precisely: it must be flexible, and needs intelligent application on the part of the farmer to get the best results.

27. The Isle of Thanet

O. MIDDLETON, N.D.A.
District Advisory Officer

THE Isle of Thanet—what romance and ancient history the name conjures up! In recent times, however, the Island has become the playground of south London, with such places as Ramsgate, Margate, Broadstairs and Cliftonville as popular with Londoners as Blackpool is with the Lancashire cotton town worker.

Charles Dickens described the broad, hedgeless fields of waving green and golden corn in the early nineteenth century when he stayed at Bleak House, Broadstairs. Saint Augustine landed in the year A.D. 597, near Pegwell Bay, and there preached his first sermon to our heathen ancestors. The Normans, when they conquered England, settled on the Island, which was in those days cut off from the mainland by the rivers Wantsum and Stour.

The channel was then navigable. Ships sailing up the English Channel to the Port of London would pass the port and castle at Richborough, to continue up the River Stour to Reculver, and so into the mouth of the Thames. This inland waterway provided a short cut to London and a safe anchorage and passage for smaller ships, avoiding the hazardous passage round the Goodwin sands and the North Foreland.

In the past, most farmers in Thanet did some fishing and smuggling, and many of the old farmhouses have secret passages and cellars cut into the Chalk which underlies the whole of the Island.

The Island is the extreme eastern tip of Kent, and comprises approximately 18,000 acres of cultivated land, bounded on two sides by the sea, and on the other sides by highly fertile alluvial marsh-land which was formed from the sea and the River Stour. It is now no longer an island in the accepted sense, as the River Wantsum is only a few feet wide. The sea nearly encircled the Island once again when in February 1953 it flooded the low-lying marsh-land on the north-east coast of Kent from Dartford to Birchington.

The soil varies from a sandy loam to a chalky loam, 1–4 feet or more in depth, overlying Chalk. There are small areas of brickearth and Thanet Sands which are highly fertile and grow excellent crops. Small areas of slightly heavier soil containing some flints are less fertile. The soil is easily worked, and because of its proximity to the sea it is early, and free from late frosts. The highest point on the Island, near Manston, is 181 feet above sea level. It enjoys a low rainfall, has a very high sunshine record, and is admirably suited to growing such crops as early potatoes, cauliflower, broccoli, spring cabbage, barley, lucerne and herbage seed.

Broccoli were introduced by Mr. Barr Sackett in 1870, and approximately 1,400 acres are now grown on the Island. Broccoli mosaic has caused serious losses in recent years, due to the spread of the causal virus by aphids from seed crops of broccoli and kale to field crops. The increase in the production of brassica crops has been influenced to a large extent by the proximity of

the London and south coast markets and the introduction of road transport. A total of 2,600 acres of market-garden crops are now grown.

It was not until the early part of the present century, when Mr. Archibald Montgomery came to Thanet from Scotland, that any large acreage of early potatoes was grown. They now occupy an important place in the rotation. The most popular varieties until the introduction of the Arran Comet were Epicure, Ulster Chieftain, Ulster Premier, Arran Pilot and Home Guard. Epicure and Home Guard have been replaced almost entirely by Comet, and the acreage of Arran Pilot has been greatly reduced. Some of the better land has grown early potatoes repeatedly for the last eight or ten years, followed by broccoli or spring cabbage, but a more usual rotation is early potatoes—mid-season and late broccoli—cauliflower—an autumn cereal crop or spring barley.

Lucerne was introduced into the rotation to rest the land from intensive cropping and to provide fodder for cattle, but in recent years the acreage has been drastically reduced, owing to serious outbreaks of *Verticillium* wilt. Herbage seed production, the S.23, S.24, S.143 and S.215 strains being the most popular, has replaced lucerne as a restorative crop. Some 400 acres are now grown, giving high yields of first-quality seed. Thanet farmers are proud of the fact that Mr. Alec Robertson has won two premier awards for S.37 cocksfoot at Toronto Fair.

Thanet malting barley has also figured in many prize-winning samples, and local-grown Plumage Archer has repeatedly won the highest award of the Institute of Brewing.

There are a few high yielding dairy herds, mainly on farms on the Island's perimeter, with access to marsh-land grazing. The sheep population has declined since Charles Dickens walked through the fields of Thanet, and it is only when Aberystwyth herbage seed production stands are grazed in the late autumn and winter that any sheep are seen on the upland of the Island. Rarely are crops grown specially to feed off to sheep, as the land has a much higher cash crop output. The sheep are confined mainly to the marsh-land areas, but even these are being ploughed up and tile drained, and excellent crops of wheat, potatoes and sugar beet are being grown.

Fertility is maintained at the highest possible level to produce early potato yields of over 6 tons an acre and over 500 boxes per acre of broccoli. Farmyard manure, seaweed and shoddy are used, supplemented by generous applications of complete fertilizer. Seaweed is collected from the shores by a local contractor and spread at a cost of about £1 per ton.

The Island is indeed a pleasant place on which to live and work, and its fame for the high standard of farming practised there has spread throughout the whole country.

THE MINISTRY'S PUBLICATIONS

Since the list published in the June 1960 number of AGRICULTURE (p. 118) the following publications have been issued.

MAJOR PUBLICATIONS

Copies are obtainable from Government Bookshops or through any bookseller at the price quoted.

Costs and Efficiency in Milk Production (*New*) 3*s.* 6*d.* (by post 3*s.* 10*d.*)
A report of the national investigation into the economics of milk production 1955–57.

BULLETINS

No. 10. Control of Rats in Sewers (*New*) 2*s.* 6*d.* (by post 2*s.* 10*d.*)
This will be of considerable help to local authorities. As well as containing up-to-date information on control techniques, it lays emphasis on the importance of planning if good results are to be achieved.

No. 34. Mushroom Growing (*Revised*) 6*s.* 0*d.* (by post 6*s.* 5*d.*)
Covers all aspects of cultivation, and sets out the advantages and disadvantages of the main systems of production.

No. 42. Feeding Dairy Cows (*Revised*) 3*s.* 6*d.* (by post 3*s.* 11*d.*)
Deals fully with the nutritive requirements of dairy cows in respect of both maintenance and milk production. There is a chapter on the economics of milk production, and a set of tables on suitable feeding and feedingstuffs.

LEAFLETS

ANIMAL HEALTH LEAFLET

Up to six single copies of Animal Health Leaflets may be obtained free on application to the Ministry (Publications), Ruskin Avenue, Kew, Surrey. Copies beyond this limit must be purchased from Government Bookshops, price 2d. (by post 4d.).

No. 6. Fluke or Liver Rot in Sheep (*Revised*)

ADVISORY LEAFLETS

Up to six single copies of Advisory Leaflets may be obtained free on application to the Ministry (Publications), Ruskin Avenue, Kew, Surrey. Copies beyond this limit must be purchased from Government Bookshops, price 3d. (by post 5d.).

No. 37. Lackey Moth (*Revised*)
No. 234. The Bullfinch (*Revised*)
No. 269. Cabbage Aphid (*Revised*)
No. 469. Destruction of Insects and Mites in Sacks (*New*)
No. 482. How to Make Grass Silage (*New*)

HORTICULTURAL MACHINERY LEAFLET

One free copy of Horticultural Machinery Leaflets may be obtained on application to the Ministry (Publications), Ruskin Avenue, Kew, Surrey. Copies beyond this limit must be purchased from Government Bookshops, price 6d. (by post 8d.)

No. 5. Pumps and Pipe Work for Heating Systems (*New*)

FIXED EQUIPMENT OF THE FARM LEAFLET

No. 3. Farm Dairies (*Revised*) 9*d.* (by post 11*d.*)

FREE ISSUES

Obtainable only from the Ministry (Publications), Ruskin Avenue, Kew, Surrey.

Farm Incomes, Costs and Management (*New*)
Farm Safety Regulations, Explanatory Note: Stationary Machinery—Welsh edition (*New*)
Farm Safety: Prevention of Accidents (*Revised*)

WALLCARD

Dermatitis Among Landworkers (*New*)

In Brief

ZERO GRAZING AT BUCKLAND

Those who attended the demonstration of zero grazing and silage-making held in late May at Buckland, Faringdon, Berkshire, heard Mr. Richard Wellesley say that zero grazing had enabled him to build up his dairy herd from about 130 to 170 without a comparable increase in the acreage allotted for feed production, and had also made the overall management of the farm definitely easier. The fully mechanized process of zero grazing meant that the feed was gathered at the best time for the crop, and was used without waste.

Grass is wilted to 70 per cent moisture content both for zero grazing and silage-making. Two feeds of grass per day provide a total of 150 lb; 2 oz calcined magnesite per animal per day are spread on top, together with a mixture of steamed bone flour, salt, and potassium iodide at the rate of 4 oz per cow per day. Concentrates are fed in the milking parlour. At the time of the demonstration the grass was giving 4 gallons per cow before any concentrates were fed. The animals apparently prefer short clean cut grass, not herbage that has been pulped up.

Fertilizer applications comprise a basic dressing of 4 cwt of a No. 1 compound, followed by 1 cwt of a nitrogenous fertilizer after each cut.

The buildings at Buckland are simple. General-purpose barns can hold a total of 2,000 tons of silage. A thousand tons of grass goes into one barn, which is built of home-grown timber with plywood walls inside the supporting posts. Forage harvested grass is brought in self-unloading trailers, and then blown into the silo. The aim is a settled depth of 17 feet of silage, covered by a plastic sheet which is sealed to the plywood walls with adhesive. The 1,000 tons of grass produce just over 700 tons of finished silage.

The silo end is removed, and a fore loader takes out the silage and places it in self-unloading trailers. These deliver 80-90 lb per cow into troughs in front of the stock buildings, which are open-fronted barns with concrete loafing areas.

Mr. Wellesley said that the health of the herd had been maintained very satisfactorily under this regimen. The herd had less bloat than with conventional grazing, and indeed no trouble at all since feeding only on wilted grass. Also the animals' feet had been maintained in good condition because of the clean, hard standing. Manure was scraped from the loafing area straight up a ramp into trailers for distribution. In the covered area, which was bedded with straw, FYM was allowed to build up to a depth of 3 feet before the annual cleaning out.

It is a pleasure to add that the organization of the demonstration was excellent.

J. H. Clift

SURVEYORS AND RESEARCH GRANTS

The Education Trust of the Royal Institution of Chartered Surveyors was established in 1955 to promote education, study and research into matters relating to the theory and practice of surveying in any of its branches. It replaces the Institution scholarships which were granted between 1905 and 1939. Since 1956, awards totalling £1,150 have been made.

It has now been agreed that the funds available should be devoted primarily to the encouragement of research at the post-graduate stage. With the development of the surveyor's profession, it is obviously desirable that research be carried out into selected aspects of the profession, as covered by the Royal Charter. Whether by individuals or by groups of members, this research, on programmes approved

by the Trustees, can only prove to be of benefit to the profession as a whole and to the Institution.

Further particulars can be obtained from the Hon. Secretary to the Trust, 12 Great George Street, London, S.W.1.

LOOKING TO AUTUMN KEEP

This year there is particular reason to plan for autumn keep in the field. Whilst it looks like being a vintage year for quality in silage and early hay crops, many farmers will be apprehensive about the size of their fodder reserves.

The usual provision for autumn keep will already have been made in the way of kale and undersown Italian ryegrass. In favoured areas, some of the stubbles can be sown in early August with a catch crop of Westerwold ryegrass for late autumn grazing. Undersown leys can be top-dressed with nitrogen immediately after harvest, to increase the pasture available in September. But the established leys and old pastures have their part to play, too.

The following notes apply to the more heavily stocked farms, where there is little chance of putting grass fields aside during August and September for foggage or "standing hay".

If you want milk or meat from pasture late in the season, the grass must keep on growing. To do this, it should go into the autumn with plenty of tillers but no excessive top-hamper, so that the maximum area of young leaf is exposed to the diminishing sunlight.

Good grazing management will begin to count *now*. No area should be grazed too bare at any time from now on. Full use must be made of grass due to be ploughed this autumn, to keep the remainder in good trim for autumn growth. Dress the sacrifice fields liberally with nitrogen *now*.

Pastures which have not been rich in clover during the summer will need up to 50 units of nitrogen per acre around mid-August, to stimulate tillering and sustain autumn growth. A light grazing a month later will further encourage tillering, and there will be more keep to follow. There is little object in delaying the main application of nitrogen after August, but in a mild autumn a small dressing in mid-September may be profitable.

J. O. Green

IS YOUR MACHINERY READY FOR HARVEST?

A systematic check of equipment to be used in the harvest may save delays in the field, and even loss of quality of grain through hurried cutting and threshing. This applies particularly to complex machines like the combine harvester and the pick-up baler; but since any kind of harvesting is largely a matter of transport, trailers and tractors ought also to come in for some attention. In the barn, the grain drier and the elevators which serve it may have become cluttered with dust since they were used last season, rust may have clogged sliding shutters, or shrinkage have deformed woodwork.

On the combine harvester it is best not to engage the engine until the various moving parts of the machine have been checked over to see that they run free. Straw and rubbish should be cleaned away, the lubrication points looked after. A knife should be put into the cutter-bar to see whether it beds down over its whole length: if it does not, the clips that are standing away from the knife must be tapped down. Belts and chains can be put on to their pulleys and sprockets, and adjusted tight enough not to slip or come off, but not tight enough to harm the bearings.

With the baler too it is worth while to make sure that all the moving parts of the mechanism can turn freely before the machine is run as a whole. The shear bolts and slip clutches should have attention. It may be found that in order to

keep going during last year's work, a safety bolt was replaced by an ordinary bolt with a higher shear strength: if so, this must be replaced. The slip clutches should be slackened off to a point at which they will slip when the machine is put into work; then they can be tightened up just enough not to slip under the working load when the machine is in the field.

It is surprising how many pneumatic tyres there are in harvesting equipment, if those on trailers and tractors are included in the count. Time spent in putting them into good order may save the long and awkward job of taking off a wheel in the field for the tyre to be repaired.

H. J. Hine

NEXT YEAR'S LAMB CROP

With the current trend towards lower sheep prices, the need for greater efficiency is self-evident. The principal cost in producing lambs is that of maintaining the ewes; thus any steps that will spread this over a greater number of lambs will reduce the costs of production. Factors such as breed, strain, age and health of the ewes will all influence lambing percentages, but these are long-term factors and it is already too late to modify them to improve next year's lamb crop. Improvements will therefore have to come from short-term measures. One of these is the practice of flushing ewes. There is ample experimental evidence to indicate that flushing increases ovulation, which in turn increases the twinning rate, but it is not now thought that flushing hastens the onset of oestrus or reduces the incidence of barrenness.

In order to flush ewes it is necessary to improve their diet before mating, and for it to be successful there are two major requirements. First, the ewes must be in a sufficiently low condition to respond to flushing and second, sufficient food of the right quality must be available at the right time. How the condition of the ewe is brought down before flushing will vary according to the circumstances of the season and the individual farm, but the chief necessities are a hard heart and good fences. In this context the recently introduced practice of intensive stocking and carefully controlled grazing management, as exemplified by the system of sideways creep grazing, can have a very useful secondary function in preventing ewes from becoming excessively fat during the latter part of the suckling period. The choice of food for flushing the ewes does not seem to be important. It can be clean grazing (possibly aftermath) which has been rested from stock and fertilized about 4 to 6 weeks before flushing, or a special catch crop such as rape or mustard.

In a year such as 1959, when there was an acute shortage of grass at the time the ewes required flushing, it was not possible to do much more than provide a clean field. However, the lamb crop obtained in 1960 suggests that this in itself did produce a considerable measure of flushing.

Flushing food should be provided about three weeks before the rams are turned into the flock, and there should be enough to maintain a high level of feeding for a further five weeks. Before putting the ewes on to this keep it is advisable to dose them with phenothiazine to reduce the worm burden.

R. J. Halley

FOUR THOUSAND YEARS OF NORFOLK FARMING

From 25th June to 2nd October, an exhibition will be held in Norwich Castle Museum, showing 4,000 years of agriculture in Norfolk.

Farmers first arrived in Norfolk about 2,500 B.C.—perhaps even before then—from the Low Countries and southern England. They felled the woodlands of Breckland and West Norfolk, sowed grain and grazed cattle. These early settlers

were probably nomadic, moving on as they exhausted the light soil in any one place.

From 500 B.C. until the Romans came, Iron Age farmers practised mixed farming in Norfolk. A model farmhouse of this period, at West Harling, is among the exhibits. In Roman times more woods were felled, and some fenland drained to grow grain. Farming prospered, and large estates sprang up, with elaborate farmhouses and extensive buildings.

By the time of the Domesday Survey in 1086, Norfolk and Suffolk were the most densely-populated part of England, and farming expanded greatly. It continued to do so for three hundred years; then from 1350 to 1650 there was something of a recession.

The late seventeenth and eighteenth centuries saw a period of slow but irrepressible progress, with the development of the Norfolk system and other new techniques popularized by Townshend and Coke. From this time until the present day the history of Norfolk farming is common knowledge; but the Norwich exhibition sheds an even clearer light on modern times than it does on prehistoric. Every visitor to Norfolk this summer should see it.

As a more permanent record, the Norwich Museums Committee have published an excellent book, combining a detailed and most interesting history of Norfolk farming with a catalogue of the Castle exhibition. This can be obtained from the Castle Museum and costs 3*s.* 6*d.* (by post 4*s.* 0*d.*).

EXPERIMENTAL FARM BUILDINGS SCHEME

Under a new scheme introduced on 1st July, the Agricultural Research Council are prepared to make grants to farmers who are willing to take part in experimental programmes involving the testing of farm buildings and of ideas affecting farm buildings. Information about the scheme is given in a free leaflet which can be obtained from any divisional office of the Ministry of Agriculture, Fisheries and Food in England; from the Area offices of the Department of Agriculture and Fisheries for Scotland or from the Secretary, Agricultural Research Council, Cunard Building, 15 Regent Street, London S.W.1.

PIG FARMING CHALLENGE TROPHY

In recognition of the important work that is going on all the time within the British pig industry—on the farm, in the factory and in the research laboratory—the publishers of the monthly periodical *Pig Farming* have decided to make a special annual award.

A silver challenge trophy will be presented each year to the person who is judged (by a committee representing all sides of the pig industry) to have made the greatest contribution to the industry in the United Kingdom.

The prize will be known as the David Black Award, in memory of the late David Black of Bacton, Suffolk, who devoted many years of his life to the cause of pig production and pig marketing in this country.

Pig farmers, as well as those engaged in research, advisory and educational work on any aspect of pig production and processing, may win the trophy. The first presentation will be made next January.

BOOK REVIEWS

The Living House. GEORGE ORDISH. Rupert Hart-Davis. 25*s*.

A house considered as a habitat for animals is not entirely a new idea, but the theme has rarely been developed so fully, or in such a readable style, as in Mr. Ordish's new book. He considers not only the various animals, large and small, which can find livelihood and shelter in a house, but the probable changes which have taken place in the composition of the fauna during the long history of Barton's End in Kent—the house was built in 1555.

Much is surmise, which would pass with little remark, if it were not presented as uncompromisingly concrete fact. A census of all the animals living in the house every fifty years since 1558 (except the mites and springtails, which seem to have defeated research), and their total biomass in pounds, is presented in Table 1. It must have been an entertaining exercise compiling these figures. But, if one forgets these quantitative excursions, there is a great deal of information to be enjoyed about the life cycles of the various commensal animals that a house harbours, and about the way in which their opportunism exploits a man's possessions.

There are many ways in which the ecology of domestic faunas can be studied, but two of them seem to me pre-eminently interesting. One is to examine the fauna as a community, tracing just how each member depends on the others and all ultimately upon the activities of man. The special interest of this approach is to observe how a new habitat evolves its own community from the adaptable members of other communities. This aspect is only lightly touched upon.

The other approach is to examine the adaptations by which each immigrant has found itself a niche, and the more informative part of the book deals with just this. The author goes out of his way to delve into the life-histories of selected wood-boring insects, spiders, mammals, birds, "dry-litter" animals like clothes moths and grain beetles and, finally, the train of parasites which troop in with their hosts. Naturalists will find much devious knowledge here, the general reader much profitable entertainment and every householder cause to wonder what is going on in his property.

It is an interesting comment that some of these opportunist animals are very rare in nature. One of our greatest nuisances, the flour beetle *Tribolium confusum*, has never been traced in its natural habitat. We never know where the next pest may come from but now, thanks to Mr. Ordish, we know what to expect.

H.N.S.

The Making of the Broads. (Royal Geographical Society Research Series No. 3.) J. M. LAMBERT, J. N. JENNINGS, C. T. SMITH, C. GREEN and J. N. HUTCHINSON. John Murray. 25*s*.

Most people who go to the Norfolk Broads go there for holidays. The authors of this book went there to work. They worked as detectives, collecting their evidence by a variety of disciplines and techniques and making it tell its story by processes of reasoning that are a delight to follow. They investigated the origin of the Broads, which had traditionally been regarded as natural lakes. But their findings gradually made a new and radically different explanation first possible, then necessary.

There was, for example, this matter of mud. The deposit on the bottom of the Broads was not the sort likely to be left there by a retreating sea, but it was the kind which would have accumulated in open excavations. Then there were the parochial and private boundaries which survived as peninsulas or as submerged ridges. Besides, the floors of the Broads are horizontal, their sides steep. All this pointed to the work of man, not of nature.

The geologist and ecologist helped to raise these questions, and the documentary historian helped to answer them. On the one hand, the earliest reference to a Broad dated from 1315, and the word did not become common until Tudor times. On the other, there were numerous references in the medieval records to a sub-

stantial peat cutting industry which developed to meet the needs of a densely populated area with few woodlands for fuel. And calculations and continental analogies showed no physical impossibility in digging pits, even of this size, in the course of three or four centuries. The conclusion is clear: the Broads, like so much of our landscape, were made by the muscles of men and animals.

But why did these diggings become lakes? The geographical historian answers this question by presenting the evidence on changing land levels. Land emergence after the Roman period encouraged the settlement of this area, notably by the Danes, and made possible the exploitation of the peatbeds. Land submergence in the later Middle Ages caused the flooding of these huge excavations; the records of the fourteenth and fifteenth centuries show the gradual change from "turbary" to "fen" and "fen and water". The records of the sixteenth century tell only of the Broads in the form we know them today. Nature gave, nature took away.

In form and style, this is a detailed, technical report by a group of specialists who undertook a research project. It is not designed for the general reader, but he will certainly read it, for it combines factual achievement with intellectual fascination. The authors of this brilliant, exciting and conclusive book have added a new chapter to the history of our countryside. They are to be congratulated and envied.

N.H.

The Veterinary Annual, 1959. Edited by W. A. POOL. John Wright and Sons. 42*s*.

Keeping pace with the flood of new information published in professional journals is particularly hard for field workers, who have not much time for reading, and often cannot reach a good library. The main purpose of *The Veterinary Annual* is to help such people by condensing news of the most important advances in many subjects into a single volume. It is estimated that about 20,000 publications on the topics covered must have appeared in 1958, and had to be studied to achieve this purpose: the tasks of selecting and summarizing from them have been accomplished with considerable success.

Some four-fifths of this first edition is taken up by almost one hundred short review articles dealing with clinical, pathological, aetiological and experimental aspects of disease, and with studies in veterinary physiology, biochemistry, pharmacology and nutrition. Twelve special articles, also by distinguished contributors, deal with particular fields of veterinary activity in Britain, and with the outlook and experience of certain overseas countries. Other sections deal with new drugs, preparations and appliances, and new publications. Plates and figures have been used wherever appropriate to illustrate the text.

While the veterinary research worker will, no doubt, continue to use other sources to cover his own special interests completely, he, too, is likely to find *The Veterinary Annual* useful in keeping abreast of important advances in related fields. Other scientists, particularly in agriculture, may also find it a valuable source of quick and ready reference. This excellent book is well produced, with a pleasing format, and the editor has succeeded in the difficult tasks of maintaining balance, ensuring a fairly uniform style and treatment throughout, and limiting to a minimum the overlapping of subject matter.

A.G.

The Technology of Food Preservation. NORMAN W. DESROSIER. Avi Publishing Company. $9.50.

It is the purpose of this book to present the elements of food preservation, and this the author has done successfully. He has filled nearly 400 pages with definite statements, yet few text-books are more economical in words. In all, 181 illustrations have been used where a graph, drawing or photograph is more effective than words, while 48 tables, most of them in an appendix, give a variety of data for reference. The facts are up to date, clearly given and sensibly assembled.

This book should help students to think intelligently about problems which arise in the preservation of food. Ready-made solutions are not quoted to all practical problems, but the reader is given enough guidance to think out his own answers. It should also be of interest to agriculturists and administrators who, being concerned with foods, may seek

some understanding of processing methods.

After a thorough explanation of the basic principles of preserving foods in acceptable forms, there are chapters which deal successively with cold storage, freezing, canning, drying, pickling, and preservation with sugar concentrates. There follows a chapter on food additives, which includes the recommendations of the FAO/WHO expert committee of 1956, and describes standard practices in the United States up to 1958.

The final chapter is concerned with developments in irradiation preservation, giving it a share of notice commensurate with current American research effort. As the author was formerly Director of the Radiation Preservation Division of the Quartermaster Food and Container Institute he is well qualified to summarize recent work. It is noteworthy that this chapter is written in a spirit of enthusiasm and optimism.

This volume, which has the stout cover, glossy paper and clear type which one usually associates with American textbooks, is obtainable from the Avi Publishing Company, P.O. Box 388, Westport, Conn., U.S.A.

K.B.W.J.

The Daffodil and Tulip Year Book, 1960. The Royal Horticultural Society. 12*s.* 6*d.*

English-speaking races are, it seems, more enthusiastic about daffodils than tulips, and the largest part of the latest year book in this series is once more devoted to this preference. New introductions and their performance on the show bench form the main theme of the majority of contributions. Some of these chronicles make rather pedestrian reading, but those by D. A. Lloyd on "The Best Exhibition Daffodils of 1959", and by Herbert Barr on the "Daffodil Trials at Wisley", are models of interesting and instructive articles based on a catalogue of varieties. They describe succinctly what is new and good, and why—the three main questions to which an answer is needed.

So great is the interest of all bulb growers today in the possibilities of chemical weed control that the symposium on herbicides will be widely studied. It seems that general recommendations cannot yet be given, but by studying the different experiences quoted, thought and consequently progress will be stimulated. In this field the answer to "Why?" is not yet forthcoming.

Tulips have been the first love of the Dutch for four hundred years, and two very informative contributions from the Netherlands reveal the depth of their accumulated knowledge. That by D. W. Lefeber on "Raising and Introducing New Tulips" is of particular interest, and gives the background to the magnificent new garden tulips. Their relationships with wild tulip species and the diversity of their form and colour are fascinating. Professor E. van Slogteren, in writing about "Broken Tulips", summarizes modern views on the virus status of these flowers, which are well illustrated in a series of colour plates. He adds a plea that broken tulips, so beloved from the seventeenth to the nineteenth century, should deservedly be grown for their beauty and not ruthlessly discarded as infective material.

The year book is very appropriately dedicated, in a particularly well-phrased tribute, to Mr. G. H. Johnstone, O.B.E., D.L., V.M.H., who has died since the date of publication.

K.H.J.

Development of the Poultry Industry in England and Wales, 1945–1959. RUPERT COLES. Poultry World. 7*s.* 6*d.*

Here is a concise, accurate and lucid account of the spectacular development of the poultry industry in the United Kingdom since the end of the second world war. It is more than a historical narrative for, in describing changes in the size and structure of the various branches of poultry keeping and in housing and management methods, the author has successfully related cause and effect.

The main trends are emphasized, such as the rapid expansion in egg production following the 1947 Agriculture Act, when the level of guaranteed prices in the early years allowed a generous profit to the producer. Later, withdrawal of the subsidy on animal feedingstuffs raised production costs and this, combined with a progressive decline in egg prices, led farmers to increase the size of their flocks in an attempt to maintain net income.

Attention is also drawn to the quick increase in the national flock average.

This is ascribed to the collective influence of improved breeding methods, the increasing use of intensive housing and the prompt, practical application of scientific advances, particularly in nutrition and disease control.

It is concluded that the combined effects of the increase in the number of fowls and of their productivity have been responsible for the change, within twenty years, from a nation importing about 29 per cent of its needs of shell eggs, to a state of self-sufficiency verging on overproduction. These facts become even more impressive when it is emphasized that the estimated consumption of shell eggs has increased by 27 per head of the population in the corresponding period.

The fascinating story is told of the birth and lusty childhood of the unsubsidized British broiler industry, after the abolition of rationing of animal feedingstuffs. I gain the impression that the author is favourably impressed with the economic and technical approach of the "broiler barons", and dampens their optimistic forward looking only by querying the effect of any future rise in world food prices.

Statistical data, not readily available elsewhere, are included in the booklet, and these will be of value and interest to all engaged with poultry.

The author does not assume the mantle of a prophet, but he has made available a wealth of information to enable the reader to reflect, conclude and predict at a critical stage in the affairs of the industry.

H.T.

Winter Keep on the Farm. IAN MOORE. Farmer and Stock-Breeder. *9s. 6d.*

This is a companion volume to Professor Moore's earlier manual, *Silage and Haymaking*. He is an enthusiastic exponent of the use of high-quality forage crops as a means of "cheaply and simply satisfying the food needs of cattle and sheep during the winter months".

In this manual he extols the virtues of kale, which is pre-eminent among the forage crops—whether judged from the standpoint of productivity, economical source of starch and protein equivalent, adaptation to different types of soil and climate, or ease of handling for feeding. No wonder Professor Moore concludes that it offers immense possibilities of cheapening production. The selection of suitable varieties, manuring, growing and methods of using kale, as well as the diseases and pests that attack the crop, are fully described in the manual.

Professor Moore discusses the use of the electric fencer for grazing kale, and describes how he controls and estimates the amount to be eaten. The relative advantages of grazing, as compared with the use of the forage harvester for cutting and carting the crop, are considered. There is also a section on the making of silage from the excess crop, so as to preserve the leaf: the stockman must learn how to use these bulky home-grown feeds to the best advantage. This is followed by a chapter on the growing and use of cabbage and rape for feeding livestock. These leafy succulents also have their advantages, and new varieties are available.

Finally, the fodder root crops—swedes, turnips and mangolds—still make an important, if lessening, contribution to winter keep. The author suggests that a combination of precision drilling and mechanical gapping, allied to the consumption of the crop *in situ*, may again bring these crops into favour.

It is instructive to note that Professor Moore finds that "the most versatile and rewarding crop to provide winter-gap feeding is Italian ryegrass".

The manual can be recommended equally to the student and to the farmer. It will repay study by farmers generally, as it contains much information that is particularly applicable to present-day farming conditions.

R.E.E.

Fisons Farm Management Book. M. MCG. COOPER. Fisons.

Both Professor Cooper and Fisons Fertilizers Limited are to be congratulated on producing this book. The firm has had the foresight to recognize that the key to improving profits is better management of the farm as a whole. Improved practices, if isolated from the management of the whole farm, often lead to lower rather than higher profits. Nowhere has this been better illustrated than in those instances where more fertilizers have been used on grassland without the assurance that the additional food will be used advantageously.

The author is also to be congratulated upon the easy, yet forceful, style in which the book is written.

Naturally it is impossible in the limited space available in a publication such as this to deal with more than general principles of management, but the book serves an essential purpose in that its farmer readers will be encouraged to look critically at what they are doing in the light of technical advances and changing economic circumstances. The emphasis in farming has changed from increased production to more economic production, and the modern farmer has to be more business minded than his father. In recent years the N.A.A.S. has developed the economic analysis of farm enterprises, and many of the District Advisory Officers spend much of their time finding the weaknesses in existing farm organizations and helping farmers to prepare budgets of new plans.

But only the farmer himself can decide upon the best plan for his farm. In making such a decision he needs to appreciate the management aspects of his business, and this book deals with many of the management problems commonly found on farms. In discussing the choice of enterprises, Professor Cooper emphasizes the wisdom of concentrating on those for which farm and farmer are well suited. He also points out the need to improve the management of permanent grass if it is to make its full contribution to a farm business. Similarly, the reclamation of rough grazings may be undertaken by surface improvement, liming, phosphating and grazing management if a farmer is short of capital, and has insufficient stock to exploit a more expensive improvement by wholesale ploughing and reseeding of uplands.

In chapters on the layout of farms and farm buildings, labour economy and choice of machinery and implements, the author emphasizes the importance of reducing operations which are demanding of labour, and substituting others where less labour is required.

The book concludes on the same note as it began—the need to be thoroughly expert in management. The content and presentation of the material will do much to promote recognition of the problems of management in farming.

Copies are obtainable free from Fisons Fertilizers Ltd., Technical Advisory Service, Harvest House, Felixstowe, Suffolk.

K.D.

Cambridge Irrigation Conference. Farm Intelligence. 3*s.* 6*d.*

This booklet contains a verbatim report of the proceedings at the first Cambridge Irrigation Conference, which was held in November 1959. Copies may be obtained from Farm Intelligence Ltd., 42 Parliament Street, London, S.W.1.

Books Received

Rothamsted Experimental Station Report, 1959. 10*s.*

Report and Proceedings of the Fourteenth Oxford Farming Conference, 4–6 January 1960. 6*s.* (Obtainable from M. H. R. Soper, Department of Agriculture, University of Oxford, Oxford.)

National Institute for Research in Dairying Report, 1959. 4*s.*

John Innes Horticultural Institution Fiftieth Annual Report, 1959. 3*s.*

Report of the School of Agriculture, University of Nottingham, 1959. 3*s.* 6*d.*

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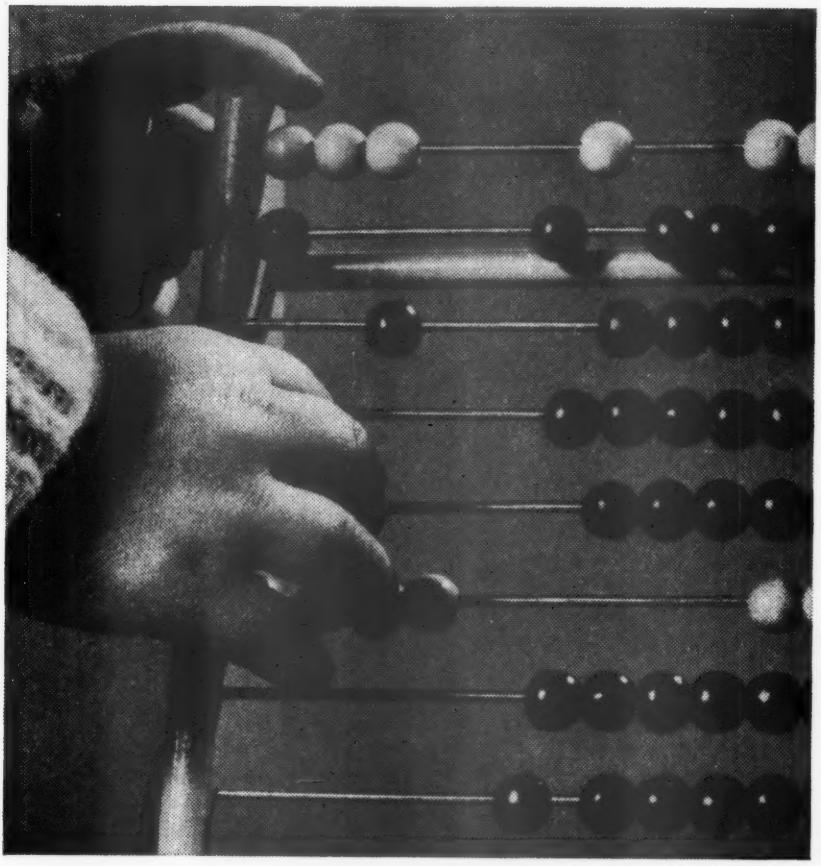

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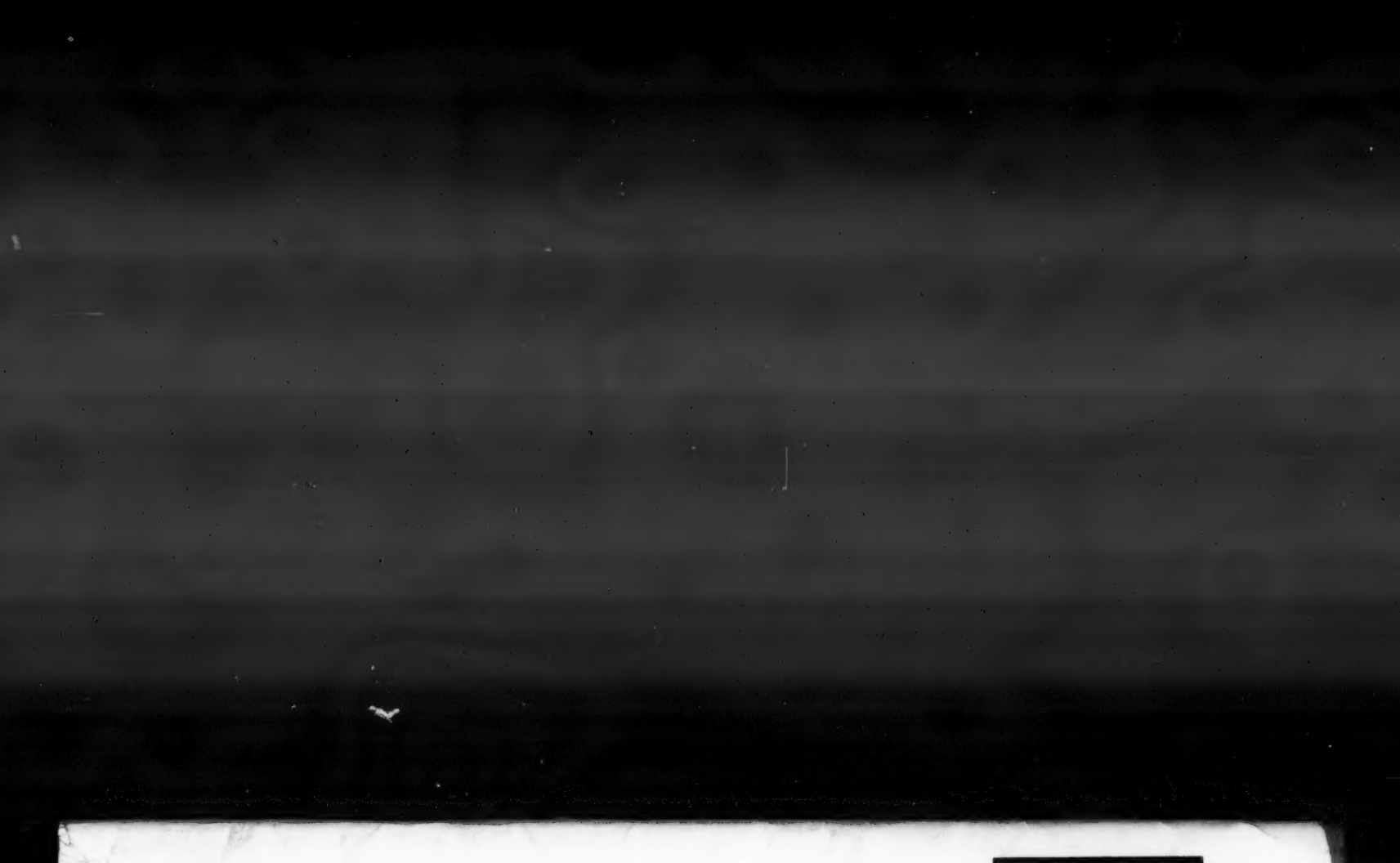
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